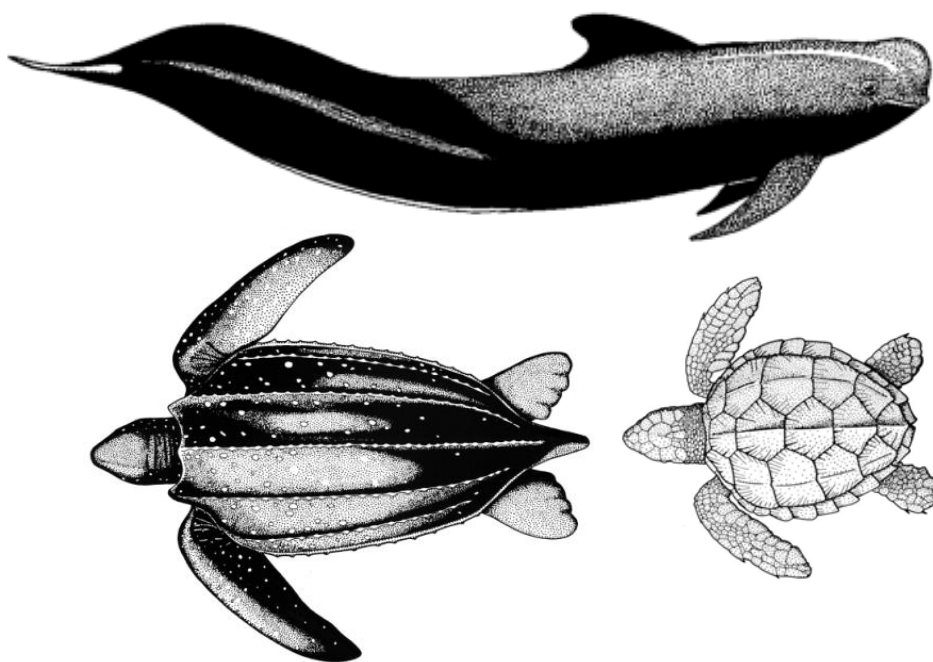




**NOAA TECHNICAL MEMORANDUM NMFS-SEFSC-572**

**Estimated Bycatch of Marine Mammals and Sea Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2007**

Carol P. Fairfield and Lance P. Garrison



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National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
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August 2008

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## Abstract

The U.S. Atlantic Pelagic Longline fleet operates throughout the northwestern Atlantic Ocean, including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the North Atlantic Ocean. The Atlantic longline fleet is defined as a Category I fishery under the Marine Mammal Protection Act, and it is also the subject of management under the Endangered Species Act due to interactions with leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) turtles. Total bycatch of marine mammals and turtles in the longline fishery was estimated for 2007 using data from the pelagic longline fishery observer program and a mandatory fishery logbook reporting program. We applied a delta-lognormal approach to estimate region specific and total annual interactions with protected species for the fishery. During 2007, there were an estimated 499 (375 – 663 95% CI) interactions with leatherback turtles, 542 (406 – 720 95% CI) interactions with loggerhead turtles, and one interaction with an olive ridley turtle (0 – 5 95% CI). The primary marine mammal interacting with this fishery was pilot whale (*Globicephala* sp.) with an estimated 87 (38 – 196 95% CI) interactions. Additional marine mammal species interacting with this fishery included an estimated 13 bottlenose dolphins (3 – 53 95% CI), 20 Risso's dolphins (7 – 62 95% CI), and 22 unidentified marine mammals (7 – 74 95% CI). Potential sources of bias and uncertainty in these bycatch estimates are discussed. During 2005 to 2007, since the implementation of regulations to reduce sea turtle bycatch rates in late 2004, the overall bycatch rate for leatherback turtles has declined by 59% and that for loggerhead turtles has declined by 22% compared to the three years prior to the regulations (2002-2004).

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## Introduction

Pelagic longline fisheries operate throughout the world's oceans targeting large pelagic fish including swordfish, tunas, and sharks. The U.S. Atlantic Pelagic Longline fleet operates throughout the northwestern Atlantic Ocean, along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the North Atlantic Ocean (Figure 1). The Atlantic longline fleet is defined as a Category I fishery under the Marine Mammal Protection Act (50 CFR Part 229, Federal Register Vol. 69, No. 135, 15 July 2003) due to frequently documented interactions with marine mammals.

The fishery is also the subject of management under the Endangered Species Act (ESA) due to frequent interactions with marine turtles including leatherback (*Dermochelys coriacea*) and loggerhead turtles (*Caretta caretta*). In June 2004, a Biological Opinion was issued by the National Marine Fisheries Service, Southeast Regional Office, finding that the U.S. Pelagic Longline Fleet posed a jeopardy to leatherback turtles in the Atlantic Ocean as defined under the ESA. To allow continued operation of the fishery, the Biological Opinion mandated increased reporting of bycatch, required education and outreach programs to train fishers in careful handling and release of turtles, and instituted large-scale changes in fishing gear. Most notably, the fishery was required to exclusively use "circle" hooks (size 16/0 or greater) after August 2004. This mandate was based upon expected reductions in bycatch rate due to hook shape and size demonstrated by experimental studies conducted in the Northeast Distant Water (NED) fishing area (Watson *et al.*, 2005).

In addition, several time-area closures were introduced into the fishery in 2000 and 2001 due to concerns over both finfish and protected species bycatch (NMFS 2003, 50 CFR Part 635). These include year-round closures near the Desoto canyon in the Gulf of Mexico after 1 November 2000 (Figure 1, Label A) and in waters off the Atlantic coast of Florida after 1 March 2001 (Figure 1, Label B). Seasonal closures are in effect in the Charleston Bump region between 1 February and 30 April (Figure 1, Label C) and in a bluefin tuna area off the New Jersey coast between 1 June and 30 June (Figure 1, Label D). The NED area was closed to non-experimental longline fishing from 2001 to 2004 in response to high turtle bycatch. However, with the implementation of gear changes, it was reopened to fishing in June 2004.

The pelagic longline fishery has had a fishery observer program (Pelagic Observer Program, POP) in place since 1992 to document finfish bycatch, characterize fishery behavior, and quantify the interactions with protected species (Beerkircher *et al.*, 2002). In addition, a mandatory fishery logbook system (FLS) has been in place since 1992 requiring vessel captains to report fishing effort, gear characteristics, and commercial catch. These data have been used to generate annual estimates of marine mammal and turtle bycatch (Johnson *et al.*, 1999; Yeung, 1999a; Yeung 1999b; Yeung, 2001; Garrison 2003; Garrison and Richards, 2004; Garrison 2005; Fairfield-Walsh and Garrison, 2006; Fairfield-Walsh and Garrison, 2007).

In this report, marine mammal and marine turtle bycatch estimates are calculated for pelagic longline fishery effort during 2007. Bycatch rates (catch per 1000 hooks) are quantified based upon observer data by fishing area and quarter. The estimated bycatch rate is then multiplied by the total fishing effort (number of hooks) reported to the FLS

program to obtain estimates of total interactions for each species of marine mammal and turtle.

## **Methodology**

### Geographic Stratification

Fishery observer effort is currently allocated among 10 large geographic areas and calendar quarter based upon the historical fishing range of the fleet (Figure 1). The target annual coverage is approximately 8% of the total reported sets, and observer effort is allocated randomly based upon reported fishing effort during the previous calendar year in each quarter/fishing area stratum (Beerkircher *et al.*, 2002). Between 15 April and 15 June of 2007, observer coverage in the Gulf of Mexico (GOM) fishing area was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. As a result, the observer coverage for this time and area is dramatically higher than is typical for other strata or previous years. The bycatch estimates developed for each species are stratified by fishing area and quarter to reflect the design of the observer program.

Bycatch rates for quarter-area strata with reported longline fishery sets that had no corresponding observer coverage in 2007 were replaced with previously observed mean bycatch rates. For most strata, the average bycatch rate for 2004-2006 was used as the best estimate of the bycatch rate during 2007. In previous years, a five-year average was used; however, the implementation of the June 2004 Biological Opinion, resulted in dramatic changes in the fishing gear used and changes in turtle bycatch rates. Therefore, the three-year average was used to better reflect the current expected bycatch rates. In one stratum, the Caribbean-Quarter 4, the most recent previous observer effort was in



2002 and 2003. To avoid creating a missing cell due to the more restricted time frame, the average bycatch rate from 2002-2006 was used for this stratum.

#### Delta Lognormal Estimator

Sets in which a portion of the longline broke away, and therefore had multiple recorded haul times, were combined into single sets. This is consistent with the approach of the most recent mortality estimates (Garrison, 2003; Garrison and Richards, 2004; Garrison, 2005; Fairfield-Walsh and Garrison, 2006; Fairfield-Walsh and Garrison, 2007). The mean and variance of catch rates for marine mammals and turtles observed in longline sets were calculated using a delta lognormal estimator (Pennington, 1993). The delta estimator is more appropriate than the simple mean because catch rates are generally log-normally distributed and bycatch events (i.e., positive sets) are rare. The unit of effort in this analysis is the number of hooks, consistent with methods used to estimate total catch and bycatch of finfish and previous analyses of protected resource interactions (Johnson *et al.*, 1999). The mean bycatch rate for each analytical stratum,  $t$ , is calculated as:

$$(1) \quad C_t = \frac{m_t}{n_t} e^{L_t} G(s_{L_t}^2/2),$$

where:

$m_t$  is the number of sets with observed bycatch,

$n_t$  is the total number of observed sets,

$L_t$  is the mean of the log-transformed number of animals taken per 1000 hooks when bycatch occurred,

$s_L^2$  is the observed sample variance of the log transformed bycatch rate, and

G is the cumulative probability function from the Poisson distribution given as:

$$(2) \quad G(s_L^2/2) = 1 + \frac{m_t - 1}{m_t} (s_L^2/2) + \sum_{j=2}^{\infty} \frac{(m_t - 1)^{2j-1}}{m_t^j (m_t + 1)(m_t + 3) \dots (m_t + 2j - 3)} \times \frac{(s_L^2/2)^j}{j!}.$$

The series was computed numerically over j terms until meeting a convergence criterion of a change in the function value of < 0.0001 with additional terms (j). Convergence was generally achieved with <10 terms. The variance of the delta estimator is:

$$(3) \quad \text{var}(C_t) = \frac{m_t}{n_t} (e^{2L_t}) \left[ \frac{m_t}{n_t} G^2(s_L^2/2) - \left( \frac{m_t - 1}{n_t - 1} \right) G\left(\frac{m - 2}{m - 1} s_L^2\right) \right].$$

When  $m_t$  is equal to 1, the mean bycatch rate reduces to the simple mean rate where

$$(4) \quad C_t = \frac{\exp(L_t)}{n_t},$$

and

$$(5) \quad \text{var}(C_t) = \left( \frac{\exp(L_t)}{n_t} \right)^2.$$

The  $C_t$  calculated above gives the mean number of animals caught per 1000 hooks in the observed trips. To estimate total interactions,  $N$ , these rates are multiplied by the total number of hooks reported to the FLS database for each analytical stratum. The stratified estimates and associated variances were summed to provide annual estimates for each species. Approximate 95% confidence intervals (95% CI) were calculated assuming log-normal distribution of total mortality as  $N/C$  and  $N \cdot C$  for the lower and upper confidence bounds respectively where:

$$(6) \quad C = \exp [ z_{\alpha} \sqrt{\text{var}(\ln N)} ],$$

and

$$(7) \text{var}(\ln N) = \ln[1 + \text{var}(N)/N^2],$$

where  $z_\alpha$  is 1.96, the z score for  $\alpha = 0.05$ .

### Sea Turtle Life History Form

Detailed information on the characteristics of longline interactions with sea turtles was recorded by the fisheries observers during 2007. These data include detailed descriptions of the type of interaction, the extent of entanglement, the location of any hook attached to the animal or swallowed, and other data (Appendix A). Detailed information on entanglement, hooked animals, and the location of hooks are shown in Table B2.

### Marine Mammal Serious Injury Determination

The Marine Mammal Protection Act (MMPA) requires that mortality and serious injury of marine mammals incidental to commercial fishing operations be reduced to a level approaching a zero mortality rate. “Serious injury” has been defined as an injury likely to result in mortality (NOAA Fisheries 50 CFR 229.2, Angliss and DeMaster, 1998). A workshop of NOAA Fisheries and external experts was convened in 1997 to evaluate the types of injuries occurring in commercial fisheries and guidelines for determining if a given marine mammal observed interacting with commercial fishing gear was seriously injured. For small cetaceans, including pilot whales and other delphinids, it was concluded that animals that ingested hooks, were released with significant amounts of trailing fishing gear, were swimming abnormally, or suffered

some obvious severe external trauma, should be considered seriously injured (Angliss and DeMaster, 1998). Serious injury determinations are made on a case by case basis after reviewing the observations and comments of fishery observers. For this report, observer comments for all takes of marine mammals from 2007 (Table B4) were reviewed and serious injury determinations were made based upon observer comments and photographs consistent with current NOAA fisheries guidelines.

## **Results and Discussion**

### Reported Fishing Effort and Observer Coverage

The total reported pelagic longline fishing effort included 6.28 million hooks during 2007 (Table 1A, Figure 2). The reported fishery effort included 8,795 sets during 2007, 944 of which were observed by the POP program (Tables 1B and 2B, Figure 2). The overall percent coverage was 10.77% expressed as a proportion of reported sets and 11.70% as a proportion of reported hooks (Table 3). The relatively high annual rate reflects 51.6% coverage of the fishery during the second quarter in the GOM. Observer coverage for other area-quarter strata is shown in Table 3.

Areas with no observer coverage during 2007 with more than 10 sets of reported fishing effort include the North Central Atlantic (NCA) during quarter 2, the Northeast Coastal (NEC) during quarters 2 and 4, the Northeast Distant (NED) during quarter 2, the Sargasso Sea (SAR) during quarter 4, and the Tuna North (TUN) during quarters 1, 2, and 4 (Table 3).

### Observed Protected Species Interactions

There were 69 observed interactions with leatherback turtles, 67 with loggerhead turtles, and one interaction with an olive ridley turtle (Table 4, Figure 3, Table B1) in 2007. All turtles were released alive. The greatest number of observed leatherback takes occurred in the GOM during the 2<sup>nd</sup> and 4<sup>th</sup> quarters, and in the MAB region during the 4<sup>th</sup> quarter (Table 4A, Figure 3, Table B1). Loggerhead takes were observed in the greatest numbers in the NED during the 3<sup>rd</sup> quarter and the MAB during the 3<sup>rd</sup> quarter (Table 4B, Figure 3, and Table B1). The olive ridley turtle was observed taken in the CAR area during the 2<sup>nd</sup> quarter (Table 4C, Figure 3, and Table B1).

The vast majority of the turtles were characterized as being released alive and injured (i.e., most had been hooked) based upon recorded information on the sea turtle life history form (Tables 5 and B2). Leatherback turtles were most typically hooked externally, while loggerhead turtles were primarily hooked in the mouth or beak or swallowed the hook (Tables 5B, B2A, and B2B). The olive ridley turtle was hooked in the tongue (Table 5B and B2C). All gear was removed before release from 85 of the 137 turtles captured (Table 5).

There were 17 interactions observed with marine mammals during 2007 (Tables 6 and B3, and Figure 4). The majority of these interactions were observed in the MAB region with pilot whales (Tables 6). Nine of the observed marine mammal interactions were categorized as serious injuries including five pilot whales, two unidentified marine mammals, one Risso's dolphin, and one bottlenose dolphin (Table 7). Four of the pilot whales serious injuries were due to animals being released with gear likely to further entangle the animal while one was confirmed to be hooked in the mouth. The two

seriously injured unidentified marine mammals were hooked in the mouth and entangled, and the Risso's dolphin was hooked in the mouth (Tables 7 and B4). One unidentified dolphin was dead upon capture (Tables 7 and B4).

Stratum estimates of total interactions for sea turtles are shown in Table 8. During 2007, high leatherback estimated interactions in occurred in the GOM in quarter 4 (134 animals), the MAB in quarter 4 (80 animals), the NEC in quarter 3 (61 animals), the GOM in quarter 2 (48 animals), the NED in quarter 3 (45 animals) and quarter 4 (40 animals), the MAB in quarter 3 (34 animals), and the GOM in quarter 3 (30 animals, Table 8, Figure 3). For loggerhead turtles, the observed interactions were highest in the NED in quarter 3 (200 animals), the MAB in quarter 3 (120 animals), the NEC in quarter 3 (43 animals), the MAB in quarter 4 (36 animals), and the FEC in quarter 4 (32 animals, Table 8, Figure 3). The estimated observed olive ridley interaction occurred in the CAR during quarter 2 (1 animal, Table 8, Figure 3).

The quarter-area strata estimates for observed marine mammal mortality, serious injury, and live releases are presented in Table 9. All observed marine mammal serious injuries occurred in the MAB region with an estimated 44.3 pilot whales in quarter 3, 12.4 pilot whales in quarter 4, 9.3 Risso's dolphins in quarter 3, and 22.2 unidentified marine mammals in quarter 3 (Table 9B, Figure 4). One unidentified dolphin was observed dead and occurred in the Gulf of Mexico (GOM) area in quarter 2 (Table 9C), resulting in an observed estimate of two dolphins caught dead in 2007.

### Estimated Interactions in Unobserved Areas with Fishing Effort

The average bycatch rates and estimated catches in strata that were not observed during 2007 are summarized in Table 10. The highest estimated take from these unobserved areas for leatherbacks included 11.5 in the NEC region in quarter 2. For loggerheads, estimated take in these unobserved cells was 5.0 or fewer (Table 10A). For marine mammals, there was observed historical take during the fourth quarter in the NEC and SAR areas. These estimated takes included 2.2 Risso's dolphins, 1.4 un-identified dolphins, and 0.9 Atlantic spotted dolphins (10B). All historical marine mammal takes were released alive and not seriously injured.

### Total Estimated Bycatch

There were estimated to be a total of 499 (375 – 663 95% CI) interactions with leatherback turtles during 2007 (Table 11A). The highest number of interactions occurred in the GOM, the MAB, the NED, and the NEC. For loggerhead turtles, the estimated total number of interactions was 542 turtles (406 – 720 95% CI, Table 11B). The areas with the highest estimated interactions during 2007 included the NED, the MAB, and the FEC. The total estimated interactions with olive ridley turtles was 1 turtle (0 – 5 95% CI) in the CAR fishing area. Annual estimates of marine mammal bycatch are shown in Table 12.

### Trends in Bycatch Estimates

The leatherback take estimate reached a historical high in 2004, and prior to that had increased nearly linearly since 1998 (Figure 5A). A significant decrease in the leatherback bycatch rate and the annual estimated number of interactions with leatherback turtles occurred beginning in 2005 after the implementation of regulations in August 2004. The 2007 estimated take of leatherback turtles is consistent with the annual numbers since 2005 and remains well below the average prior to implementation of the gear regulations.

Loggerhead turtle interactions since 2000 have been well below historical highs occurring in the mid-1990's (Figure 5B). Following the implementation of regulations, the bycatch dropped in 2005, but has rebounded to be slightly lower than the pre-regulation period.

Dividing the total estimated bycatch by the number of hooks (x1000) provides a measure of the overall bycatch rate. For the three-year period preceding implementation of the circle hook regulations (2002-2004), this ratio was 0.172 for leatherback turtles. This ratio excludes experimental fishing in the NED area during 2002 and 2003 that used prescribed fishing gear to test the effectiveness of circle hooks at reducing turtle bycatch. In the three year period since implementation (2005-2007), that ratio was 0.071 which is a 59% decrease in leatherback bycatch rates. For loggerhead turtles, the 2002-2004 bycatch rate was 0.102, while it was 0.079 for 2005-2007. This is a 22% decrease in the bycatch rate for loggerhead turtles. The management actions put in place in 2004 appear to have resulted in consistent declines in bycatch rates for leatherback turtles; however, the results for loggerhead turtles are less apparent. Additional years of data and analyses



will be required to fully assess the impacts of the management efforts to reduce turtle bycatch in the longline fishery.

There were an estimated 87 pilot whales interactions with the longline fishery during 2007 (Table 12). For pilot whales, the 2007 estimate was lower than that from 2005 and 2006 (Figure 6A). The bycatch estimate of 20.3 Risso's dolphins is an increase over 2006, but the estimates are consistent with the relatively low bycatch observed since 2003 (Figure 6B).

#### Sources of Bias and Uncertainty

The fishery logbook data is a mandatory reporting program, and thus it is expected that reporting rates are generally high. Due to the intense management focus on the longline fishery, there has been close monitoring of reporting rates, and observed trips can be directly linked to reported effort. In general, the gear characteristics and amount of observed effort is consistent with the reported effort. However, reporting errors are possible in this fishery that would result in a bias in bycatch estimates.

Observer coverage in the pelagic longline fishery is generally high, particularly in comparison to that of other commercial fisheries. The sampling level is sufficient to provide reasonably precise estimates of interactions with protected species. The observed coefficients of variation for annual estimates of both loggerhead and leatherback turtles are well below the 30% benchmark established by guidelines for precision set by NOAA Fisheries. However, in some strata there is little or no coverage during particular times of year. During 2007, the most notable gaps in coverage occurred in the NCA region, which had no observer coverage during any time of year, the NEC and TUN areas which had no

observer coverage except during quarter 3, and the SAR area which only had observer coverage during quarter 1. Bycatch estimates based upon previous years' data could be calculated for all of these areas except for TUN in quarters 2 and 4. Applying observer data from previous years is inherently uncertain since bycatch rates can vary significantly in time and space. We have used the average bycatch rate during the last three years to fill these cells to account for the expected effects of implementing the 2004 regulations. However, estimates for those strata supplemented by previous years' observer coverage should be treated with caution.

For some strata, there has been no recent observer coverage, and thus regional and annual estimates of bycatch are potentially negatively biased. The TUN area has had relatively little historical coverage, and as a result, no bycatch estimate is possible for quarters 2 and 4 in this area. There was relatively low fishing effort in TUN prior to 2005; however, the effort in this area has increased during the last several years. The lack of information on this area results in a negative bias in the bycatch estimates of unknown magnitude.

The delta estimator was applied to calculate bycatch rates primarily to maintain consistency with previous estimates for this fishery (Johnson *et al.*, 1999; Yeung, 1999a; Yeung, 1999b; Yeung, 2001; Garrison, 2003; Garrison and Richards, 2004; Garrison, 2005; Fairfield-Walsh and Garrison, 2006; Fairfield-Walsh and Garrison, 2007). This approach assumes that: 1) catch rates (animals per hook) are log-normally distributed, and 2) the number of hooks is an appropriate unit of effort. The first assumption was critically examined for sea turtles in Johnson *et al.* (1999); however, it is difficult to verify for marine mammals given the generally low rate of these interactions. The delta

estimator is sensitive to the assumption of log-normality, and violations of this assumption may result in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. The current approach assumes that total bycatch is linearly related to the total number of hooks fished. If this assumption is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias, of unknown direction and magnitude, in the estimate of total bycatch.

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## **List of Tables and Figures**

**Table 1.** Total amount of fishing effort reported to the pelagic longline logbook program during 2007 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets.

**Table 2.** Total amount of fishing effort observed during 2007 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets. Dashes indicate cells where no fishery effort was reported.

**Table 3.** Percentage of reported fishing effort observed during 2007 by quarter and fishing area by A) Number of hooks and B) Number of sets. Dashes indicate no reported fishing effort. Cells in which >10 longline sets were reported with no observer coverage are indicated in bold. Totals indicate overall percentage coverage by area and quarter.

**Table 4.** Total number of observed interactions with A) Leatherback turtles, B) Loggerhead turtles, C) Olive Ridley, and D) All sea turtles in the pelagic longline fishery during 2007 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported.

**Table 5.** Summary of A) Release condition, B) Hook location in hooked animals, and C) Animals with all gear removed, by hook location for sea turtles observed in the pelagic longline fishery during 2007. Hook location information is recorded on the sea turtle life history form (Appendix A) by the observer.

**Table 6.** Total number marine mammals observed in interactions with the pelagic longline fishery during 2007 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported.

**Table 7.** Summary of release condition and serious injury types for marine mammals observed in the pelagic longline fishery during 2007. Serious injury determinations were based upon written observer comments (Table B4). “Entangled” indicates that the animal was released with > 4 feet of gear remaining attached.

**Table 8.** Estimated observed interactions with sea turtles in the pelagic longline fishery during 2007 by fishing area and quarter. All turtles were released alive (either injured or uninjured).

**Table 9.** Estimated observed A) Release Alive, B) Serious Injury, C) Dead and D) Total Interactions with marine mammals in the pelagic longline fishery during 2007 by fishing area and quarter.

**Table 10.** Estimated interactions in the pelagic longline fishery for strata with reported fishing effort but no observer coverage during 2007. Bycatch rates (Mean CPUE) are the average of the stratum rates during 2004-2006 with the exception of the CAR Quarter 4

stratum where the historical bycatch rate was estimated as the average of 2002-2006. Estimates are shown for A) Turtles and B) Marine mammals. All previously observed turtles were released alive (injured or uninjured).

**Table 11.** Total estimated interactions with A) Leatherback, B) Loggerhead, and C) Olive Ridley turtles in the pelagic longline fishery during 2007 by fishing area. These estimates include extrapolated values for areas with no observer coverage during 2007 that had observed interactions during the past three years (see Table 10). All turtles were released alive.

**Table 12.** Total estimated interactions with marine mammals in the pelagic longline fishery during 2007. These estimates include extrapolated values for areas with no observer coverage during 2007 that had observed interactions during the past three years (see Table 10).

**Figure 1.** Pelagic longline fishing areas in the North Atlantic Ocean: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North. Year-round closed areas in the DeSoto Canyon (A) and the Florida East Coast (B) are indicated along with seasonal closures in the Charleston Bump (C) and in the Mid-Atlantic (D).

**Figure 2.** Observed and reported pelagic longline fishing effort during 2007.

**Figure 3.** Observed pelagic longline fishing effort and sea turtle takes during 2007.

**Figure 4.** Observed pelagic longline fishing effort and marine mammal takes during 2007.

**Figure 5.** Historical trends in fishery effort and estimated marine turtle takes in the pelagic longline fishery between 1992 and 2007 for A) Leatherback Turtles, and B) Loggerhead Turtles. Errors bars represent 95% confidence intervals.

**Figure 6.** Historic trends in fishery effort and estimated marine mammal takes in the pelagic longline fishery between 1992 and 2007 for A) Pilot Whales, and B) Risso's Dolphins. Errors bars represent 95% confidence intervals.

**Table 1.** Total amount of fishing effort reported to the pelagic longline logbook program during 2007 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets.

**A. Number of Hooks (thousands)**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	14.7	127.4	782.7	116.1	0.0	0.0	0.0	121.2	79.8	30.1	1272.0
2	12.4	90.0	546.4	174.5	11.4	35.7	14.6	409.4	3.1	75.8	1373.3
3	0.0	71.8	849.6	497.8	0.0	261.7	204.5	73.0	0.0	42.8	2001.2
4	5.5	55.9	730.3	529.3	0.0	29.1	86.0	136.3	19.7	41.8	1633.9
<b>Total</b>	<b>32.6</b>	<b>345.1</b>	<b>2909.0</b>	<b>1317.7</b>	<b>11.4</b>	<b>326.5</b>	<b>305.1</b>	<b>739.9</b>	<b>102.6</b>	<b>190.5</b>	<b>6280.4</b>

**B. Number of Sets**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	19	213	1045	170	0	0	0	156	97	43	1743
2	16	205	800	295	13	40	19	523	4	85	2000
3	0	183	1138	710	0	320	232	157	0	46	2786
4	6	128	982	712	0	35	97	234	22	50	2266
<b>Total</b>	<b>41</b>	<b>729</b>	<b>3965</b>	<b>1887</b>	<b>13</b>	<b>395</b>	<b>348</b>	<b>1070</b>	<b>123</b>	<b>224</b>	<b>8795</b>

**Table 2.** Total amount of fishing effort observed during 2007 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets. Dashes indicate cells where no fishery effort was reported.

**A. Number of Hooks (thousands)**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	2.1	18.3	49.1	6.0	-	-	-	12.5	7.7	0.0	95.7
2	12.4	11.0	304.5	3.7	0.0	0.0	0.0	7.8	0.0	0.0	339.4
3	-	11.2	51.9	41.4	-	11.0	27.4	8.7	-	13.5	165.1
4	0.0	3.6	62.8	52.4	-	0.0	11.1	4.2	0.0	0.0	134.1
<b>Total</b>	<b>14.5</b>	<b>44.1</b>	<b>468.3</b>	<b>103.5</b>	<b>0.0</b>	<b>11.0</b>	<b>38.5</b>	<b>33.2</b>	<b>7.7</b>	<b>13.5</b>	<b>734.3</b>

**B. Number of Sets**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	3	20	58	10	-	-	-	14	10	0	115
2	16	16	413	8	0	0	0	11	0	0	464
3	-	26	71	42	-	12	30	18	-	13	212
4	0	7	73	52	-	0	14	7	0	0	153
<b>Total</b>	<b>19</b>	<b>69</b>	<b>615</b>	<b>112</b>	<b>0</b>	<b>12</b>	<b>44</b>	<b>50</b>	<b>10</b>	<b>13</b>	<b>944</b>



**Table 3.** Percentage of reported fishing effort observed during 2007 by quarter and fishing area by A) Number of hooks and B) Number of sets. Dashes indicate no reported fishing effort. Cells in which >10 longline sets were reported with no observer coverage are indicated in bold. Totals indicate overall percentage coverage by area and quarter.

**A. Number of Hooks**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	14.47	14.34	6.27	5.13	-	-	-	10.32	9.59	<b>0</b>	7.52
2	100.00	12.25	55.71	2.09	<b>0</b>	<b>0</b>	<b>0</b>	1.92	0	<b>0</b>	24.71
3	-	15.58	6.11	8.31	-	4.22	13.40	11.88	-	31.57	8.25
4	0	6.38	8.60	9.90	-	<b>0</b>	12.88	3.11	<b>0</b>	<b>0</b>	8.21
<b>Total</b>	<b>44.48</b>	<b>12.78</b>	<b>16.10</b>	<b>7.85</b>	<b>0</b>	<b>3.37</b>	<b>12.62</b>	<b>4.49</b>	<b>7.5</b>	<b>7.09</b>	<b>11.70</b>

**B. Number of Sets**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	15.79	9.39	5.55	5.88	-	-	-	8.97	10.31	<b>0</b>	6.60
2	100.00	7.80	51.63	2.71	<b>0</b>	<b>0</b>	<b>0</b>	2.10	0	<b>0</b>	23.2
3	-	14.21	6.23	5.92	-	3.75	12.93	11.46	-	28.26	7.61
4	0	5.47	7.43	7.30	-	<b>0</b>	14.43	2.99	<b>0</b>	<b>0</b>	6.75
<b>Total</b>	<b>46.34</b>	<b>9.46</b>	<b>15.51</b>	<b>5.94</b>	<b>0</b>	<b>3.04</b>	<b>12.64</b>	<b>4.67</b>	<b>8.13</b>	<b>5.80</b>	<b>10.77</b>

**Table 4.** Total number of observed interactions with A) Leatherback turtles, B) Loggerhead turtles, C) Olive Ridley and D) All sea turtles in the pelagic longline fishery during 2007 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported.

**A. Leatherback Turtles**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0	1	0	0	X	X	X	0	0	-	1
2	1	0	30	0	-	-	-	0	-	-	31
3	X	0	1	3	X	3	6	0	X	0	13
4	-	0	11	8	X	-	5	0	-	-	24
<b>Total</b>	<b>1</b>	<b>1</b>	<b>42</b>	<b>11</b>	<b>-</b>	<b>3</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>69</b>

**B. Loggerhead Turtles**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	1	2	0	0	X	X	X	3	0	-	6
2	0	2	6	0	-	-	-	0	-	-	8
3	X	3	0	10	X	2	31	1	X	0	47
4	-	2	0	4	X	-	0	0	-	-	6
<b>Total</b>	<b>1</b>	<b>9</b>	<b>6</b>	<b>14</b>	<b>-</b>	<b>2</b>	<b>31</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>67</b>

**C. Olive Ridley Turtles**

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0	0	0	0	X	X	X	0	0	-	0
2	1	0	0	0	-	-	-	0	-	-	1
3	X	0	0	0	X	0	0	0	X	0	0
4	-	0	0	0	X	-	0	0	-	-	0
<b>Total</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>

**Table 4 cont.**

**D. All Turtles**

<b>Quarter</b>	<b>CAR</b>	<b>FEC</b>	<b>GOM</b>	<b>MAB</b>	<b>NCA</b>	<b>NEC</b>	<b>NED</b>	<b>SAB</b>	<b>SAR</b>	<b>TUN</b>	<b>Total</b>
1	1	3	0	0	X	X	X	3	0	-	7
2	2	2	36	0	-	-	-	0	-	-	40
3	X	3	1	13	X	5	37	1	X	0	60
4	-	2	11	12	X	-	5	0	-	-	30
<b>Total</b>	<b>3</b>	<b>10</b>	<b>48</b>	<b>25</b>	<b>-</b>	<b>5</b>	<b>42</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>137</b>

**Table 5.** Summary of A) Release condition, B) Hook location in hooked animals, and C) Animals with all gear removed, by hook location for sea turtles observed in the pelagic longline fishery during 2007. Hook location information is recorded on the sea turtle life history form (Appendix A) by the observer.

**A. Release condition**

Species	Alive, uninjured	Alive, unknown	Alive, injured	Dead	Total
Leatherback	8	4	57	0	69
Loggerhead	2	2	63	0	67
Olive Ridley	0	0	1	0	1
<b>Total</b>	<b>10</b>	<b>6</b>	<b>121</b>	<b>0</b>	<b>137</b>

**B. Hook Location in hooked animals**

				Internal			External	Total
Species	Not Hooked	Unknown if Hooked	Hooked, Location Unknown	Unknown Internal	Swallowed	Beak or Mouth		
Leatherback	8	4	7	0	1	3	46	69
Loggerhead	2	2	1	0	12	46	4	67
Olive Ridley	0	0	0	0	0	1	0	1
<b>Total</b>	<b>10</b>	<b>6</b>	<b>8</b>	<b>0</b>	<b>13</b>	<b>50</b>	<b>50</b>	<b>137</b>

**C. Animals with all gear removed, by hook location**

				Internal			External	Total
Species	Not Hooked	Unknown if Hooked	Hooked, Location Unknown	Unknown Internal	Swallowed	Beak or Mouth		
Leatherback	8	3	0	0	0	2	16	29
Loggerhead	2	2	1	0	4	43	3	55
Olive Ridley	0	0	0	0	0	1	0	1
<b>Total</b>	<b>10</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>46</b>	<b>19</b>	<b>85</b>

**Table 6.** Total number of marine mammals observed in interactions with the pelagic longline fishery during 2007 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported.

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0	0	0	0	0	X	X	0	0	-	0
2	0	0	4	0	-	-	-	0	-	-	4
3	X	0	0	8	X	0	0	0	X	0	8
4	-	0	0	5	X	-	0	0	-	-	5
<b>Total</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17</b>

**Table 7.** Summary of release condition and serious injury types for marine mammals observed in the pelagic longline fishery during 2007. Serious injury determinations were based upon written observer comments (Table B4). “Entangled” indicates that the animal was released with > 4 feet of gear remaining attached.

Species	Alive	Dead	Serious Injury Type				Total
			Mouth hooked	Entangled	Mouth Hooked & entangled	Serious injury total	
Unid. Beaked Whale	1	0	0	0	0	0	1
Bottlenose Dolphin	1	0	0	1	0	1	2
Pilot Whale	3	0	1	4	0	5	8
Risso’s Dolphin	1	0	1	0	0	1	2
Unidentified Dolphin	1	1	0	0	0	0	2
Unidentified Marine Mammal	0	0	0	0	2	2	2
<b>Total</b>	<b>7</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>2</b>	<b>9</b>	<b>17</b>

**Table 8.** Estimated interactions with marine turtles in the pelagic longline fishery during 2007 by fishing area and quarter. All turtles were released alive (either injured or uninjured).

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	1	FEC	1	20	0.0521	1.0000	127.4	6.62
Leatherback	2	CAR	1	16	0.0789	1.0000	12.4	0.98
Leatherback	2	GOM	28	413	0.0878	0.1874	546.5	47.96
Leatherback	3	GOM	1	71	0.0352	1.0000	849.6	29.91
Leatherback	3	MAB	3	42	0.0679	0.5678	497.8	33.82
Leatherback	3	NEC	3	12	0.2315	0.5222	261.7	60.58
Leatherback	3	NED	6	30	0.2197	0.3737	204.5	44.93
Leatherback	4	GOM	9	73	0.1831	0.3333	730.3	133.68
Leatherback	4	MAB	8	52	0.1517	0.3300	529.3	80.28
Leatherback	4	NED	5	14	0.4589	0.3722	86.0	39.48
Loggerhead	1	CAR	1	3	0.3949	1.0000	14.7	5.82
Loggerhead	1	FEC	2	20	0.0833	0.6882	127.4	10.62
Loggerhead	1	SAB	3	14	0.2252	0.5312	121.2	27.30
Loggerhead	2	FEC	2	16	0.2298	0.6895	90.0	20.69
Loggerhead	2	GOM	5	413	0.0190	0.4659	546.4	10.37
Loggerhead	3	FEC	3	26	0.2711	0.5541	71.8	19.47
Loggerhead	3	MAB	9	42	0.2406	0.3106	497.8	119.80
Loggerhead	3	NEC	2	12	0.1640	0.6756	261.7	42.91
Loggerhead	3	NED	15	30	0.9762	0.2683	204.5	199.69
Loggerhead	3	SAB	1	18	0.0926	1.0000	73.0	6.76
Loggerhead	4	FEC	2	7	0.5692	0.6456	55.9	31.81
Loggerhead	4	MAB	3	52	0.0673	0.5957	529.3	35.63
Olive Ridley	2	CAR	1	16	0.0755	1.0000	12.4	0.93

**Table 9.** Estimated A) Released Alive, B) Serious Injury, C) Dead, and D) Total Interactions with marine mammals in the pelagic longline fishery during 2007 by fishing area and quarter.

**A. Released Alive**

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Bottlenose Dolphin	2	GOM	1	413	0.0034	1.0000	546.4	1.9
Bottlenose Dolphin	4	MAB	1	52	0.0204	1.0000	529.3	10.8
Risso's Dolphin	4	MAB	1	52	0.0167	1.0000	529.3	8.8
Beaked Whale	2	GOM	1	413	0.0027	1.0000	546.4	1.5
Pilot Whale	3	MAB	1	42	0.0220	1.0000	497.8	11.0
Pilot Whale	4	MAB	2	52	0.0374	0.7009	529.3	19.8
Unidentified Dolphin	2	GOM	1	413	0.0026	1.0000	546.4	1.4

**B. Serious Injury**

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Risso's Dolphin	3	MAB	1	42	0.0187	1.0000	497.8	9.3
Pilot Whale	3	MAB	2	42	0.0889	0.7815	497.8	44.3
Pilot Whale	4	MAB	1	52	0.0235	1.0000	529.3	12.4
Unidentified Marine Mammal	3	MAB	2	42	0.0445	0.6986	497.8	22.2



### C. Dead

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Unidentified Dolphin	2	GOM	1	413	0.0027	1.0000	546.4	1.5

### D. Total Interactions

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Bottlenose Dolphin	2	GOM	1	413	0.0034	1.0000	546.4	1.8
Bottlenose Dolphin	4	MAB	1	52	0.0204	1.0000	529.3	10.8
Risso's Dolphin	3	MAB	1	42	0.0188	1.0000	497.8	9.3
Risso's Dolphin	4	MAB	1	52	0.0167	1.0000	529.3	8.8
Beaked Whale	2	GOM	1	413	0.0027	1.0000	546.4	1.5
Pilot Whale	3	MAB	3	42	0.1094	0.6314	497.8	54.5
Pilot Whale	4	MAB	3	52	0.0608	0.5698	529.3	32.2
Unidentified Dolphin	2	GOM	2	413	0.0053	0.7064	546.4	2.9
Unidentified Marine Mammal	3	MAB	2	42	0.0445	0.6986	497.8	22.1

**Table 10.** Estimated interactions in the pelagic longline fishery for strata with reported fishing effort but no observer coverage during 2007. Bycatch rates (Mean CPUE) are the average of the stratum rates during 2004-2006 with the exception of the CAR Quarter 4 stratum where the historical bycatch rate was estimated as the average of 2002-2006. Estimates are shown for A) Turtles and B) Marine mammals. All previously observed turtles were released alive (injured or uninjured).

#### A. Turtles

Species	Quarter	Area	# Positive Sets 2004-2006	# Observed Sets 2004- 2006	Mean CPUE 2004-2006	CV CPUE 2004-2006	# Hooks Reported (X1000) - 2007	Estimated Catch - 2007
Leatherback	2	NCA	0	11	0	-		0
Leatherback	2	NEC	4	16	0.3230	0.4588	35.7	11.5
Leatherback	4	CAR	0	10	0	-		0
Leatherback	4	NEC	2	14	0.1512	0.6855	29.1	4.4
Leatherback	4	SAR	5	21	0.2384	0.4041	19.7	4.7
Loggerhead	2	NCA	1	11	0.0842	1.0000	11.4	1.0
Loggerhead	2	NEC	2	16	0.1408	0.6832	35.7	5.0
Loggerhead	4	CAR	1	10	0.2451	1.0000	5.5	1.4
Loggerhead	4	NEC	0	14	0	-		0
Loggerhead	4	SAR	3	21	0.1932	0.5717	19.7	3.8

#### B. Marine Mammals

Species	Interaction Type	Quarter	Area	# Positive Sets 2004- 2006	#Observed Sets 2004-2006	Mean CPUE 2004-2006	CV CPUE 2004-2006	# Hooks Reported (X1000) 2007	Estimated Catch 2007
Risso's Dolphin	Released Alive	4	NEC	1	14	0.0748	1.0000	29.1	2.2
Un-identified Dolphin	Released Alive	4	SAR	1	21	0.0441	1.0000	19.7	1.4
Atlantic Spotted Dolphin	Released Alive	4	SAR	1	21	0.0735	1.0000	19.7	0.9

**Table 11.** Total estimated interactions with A) Leatherback, B) Loggerhead, and C) Olive Ridley turtles in the pelagic longline fishery during 2007 by fishing area. These estimates include extrapolated values for areas with no observer coverage during 2007 but that had observed interactions during the 2004-2006 (see Table 10). All turtles were released alive.

**A. Leatherback Turtles**

<b>Area</b>	<b>Total</b>	<b>Total CV</b>	<b>Total 95% Confidence Interval</b>
CAR	1.0	1.00	0.2 – 4.8
FEC	6.6	1.00	1.4 – 32.4
GOM	211.6	0.2572	130.6 – 342.7
MAB	114.1	0.2868	66.8 – 194.8
NCA	0	-	0
NEC	76.5	0.4212	35.4 – 165.2
NED	84.4	0.2643	51.4 – 138.5
SAB	0	-	0
SAR	4.7	0.4041	2.2 – 9.9
TUN	0	-	0
<b>Total</b>	<b>498.9</b>	<b>0.1502</b>	<b>375.3 – 663.2</b>

**Table 11 cont.**

**B. Loggerhead Turtles**

<b>Area</b>	<b>Total</b>	<b>Total CV</b>	<b>Total 95% Confidence Interval</b>
CAR	7.2	1.0000	1.8 – 28.6
FEC	82.6	0.3414	43.9 – 155.5
GOM	10.4	0.4659	4.5 – 24.1
MAB	155.4	0.2756	92.8 – 260.3
NCA	1.0	1.0000	0.2 – 4.7
NEC	47.9	0.6090	16.4 – 139.8
NED	199.7	0.2683	120.8 – 330.1
SAB	34.1	0.4698	14.5 – 79.8
SAR	3.8	0.5717	1.4 – 10.5
TUN	0	-	0
<b>Total</b>	<b>542.0</b>	<b>0.1507</b>	<b>407.3 – 721.2</b>

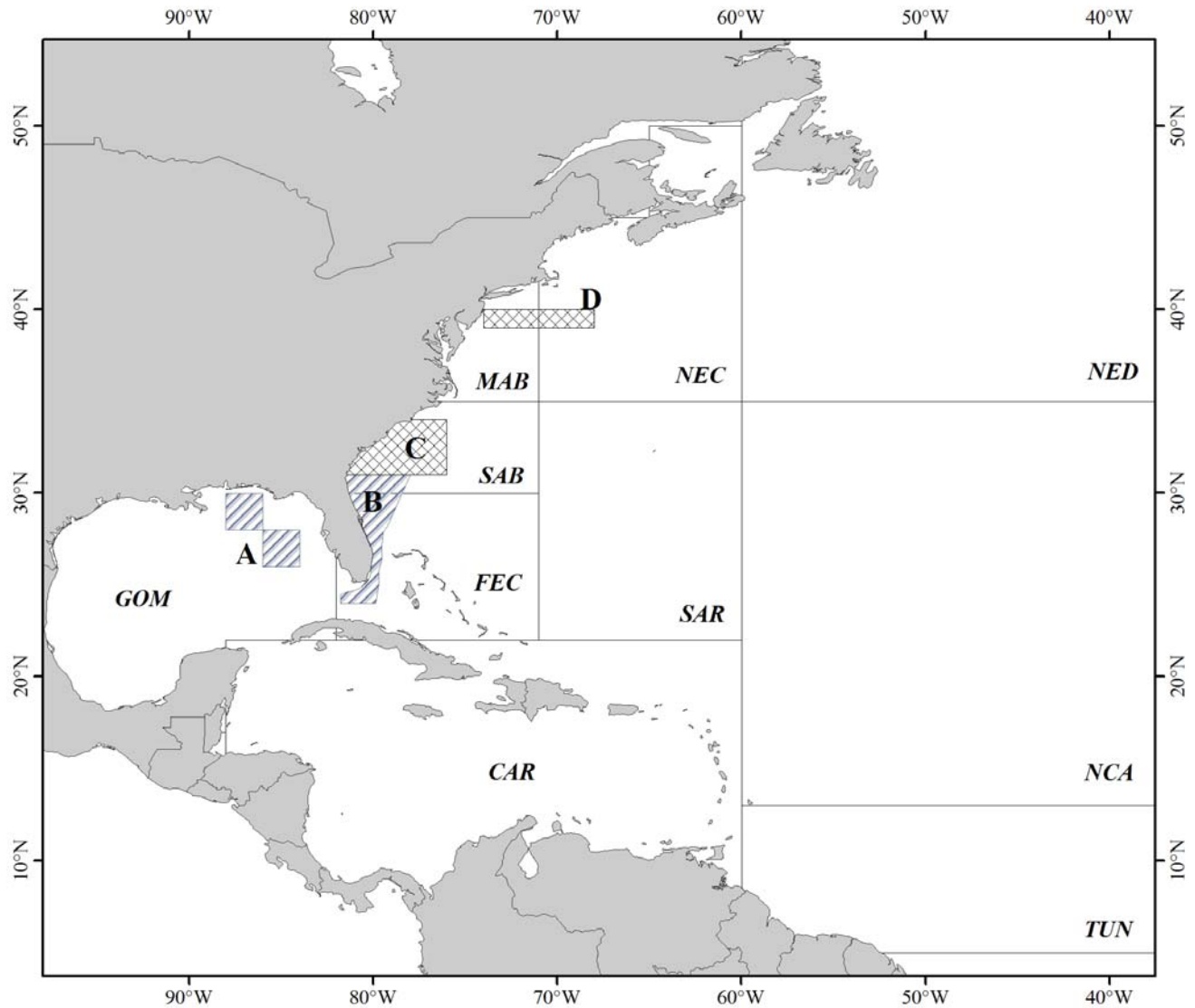
**C. Olive Ridley Turtles**

<b>Area</b>	<b>Total</b>	<b>Total CV</b>	<b>Total 95% Confidence Interval</b>
FEC	0.9	1.0000	0.2 – 4.6
<b>Total</b>	<b>0.9</b>	<b>1.0000</b>	<b>0.2 – 4.6</b>

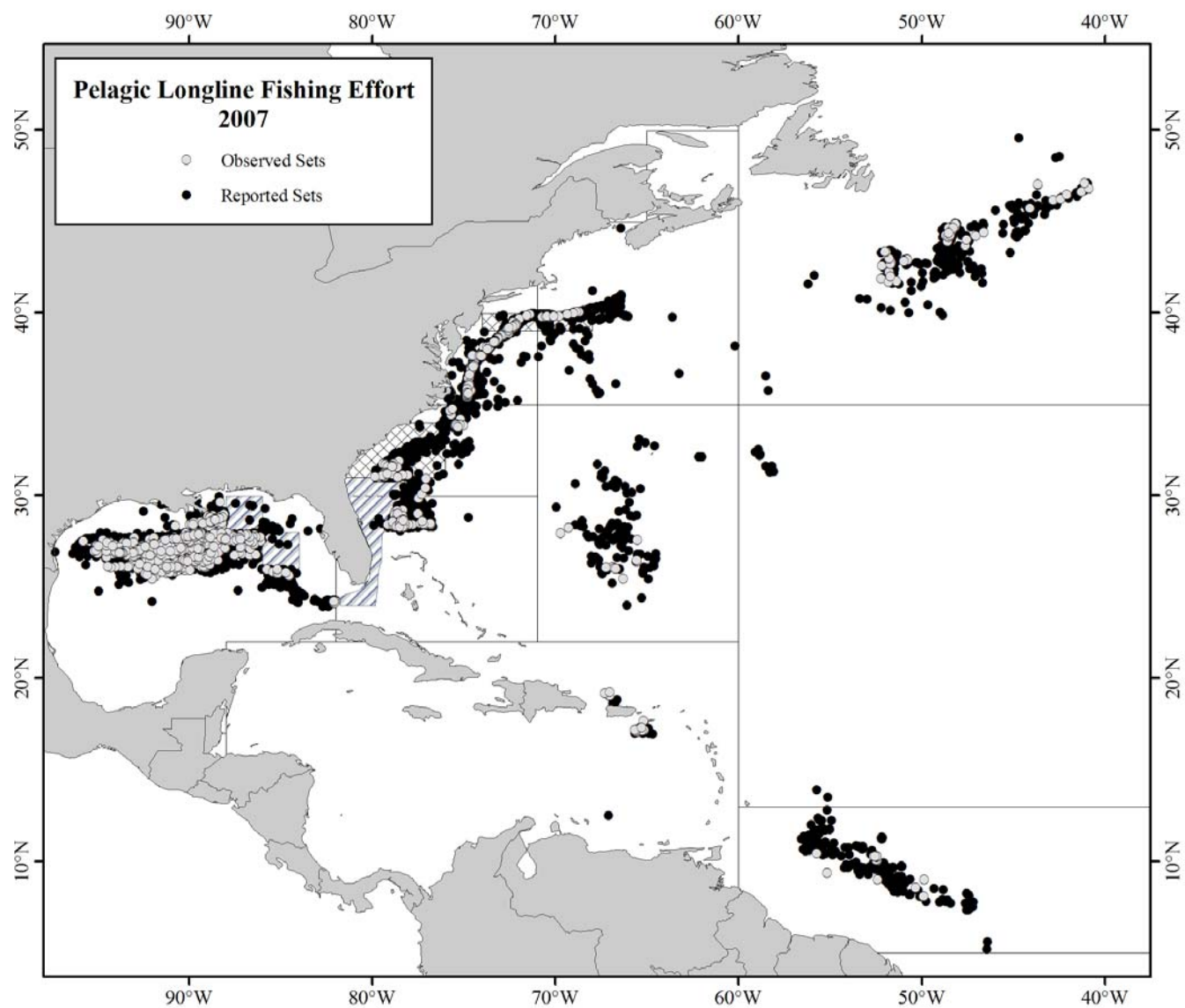
**Table 12.** Total estimated interactions with marine mammals in the pelagic longline fishery during 2007. These estimates include extrapolated values for areas with no observer coverage during 2007 that had observed interactions during 2004-2006 (see Table 10).

Species	Estimated Alive	CV Alive	Estimated Serious Injury	CV Serious Injury	Estimated Dead	CV Dead	Estimated Total	CV Total	95% Confidence Interval
Atlantic Spotted Dolphin	1.4	1.0000	0	-	0	-	1.4	1.0000	0.3 – 7.1
Bottlenose Dolphin	12.6	0.8670	0	-	0	-	12.6	0.8670	3.0 – 52.7
Risso's Dolphin	11.0	0.8264	9.3	1.000	0	-	20.3	0.6531	6.7 – 62.2
Beaked Whale	1.5	1.0000	0	-	0	-	1.5	1.0000	0.3 – 7.2
Pilot Whale	30.7	0.5750	56.7	0.6485	0	-	86.6	0.4498	38.2 – 196.4
Unidentified Dolphin	2.3	0.7270	0	-	1.5	1.0000	3.8	0.5902	1.3 – 10.6
Unidentified Marine Mammal	0	-	22.1	0.6986	0	-	22.1	0.6986	6.7 – 73.6

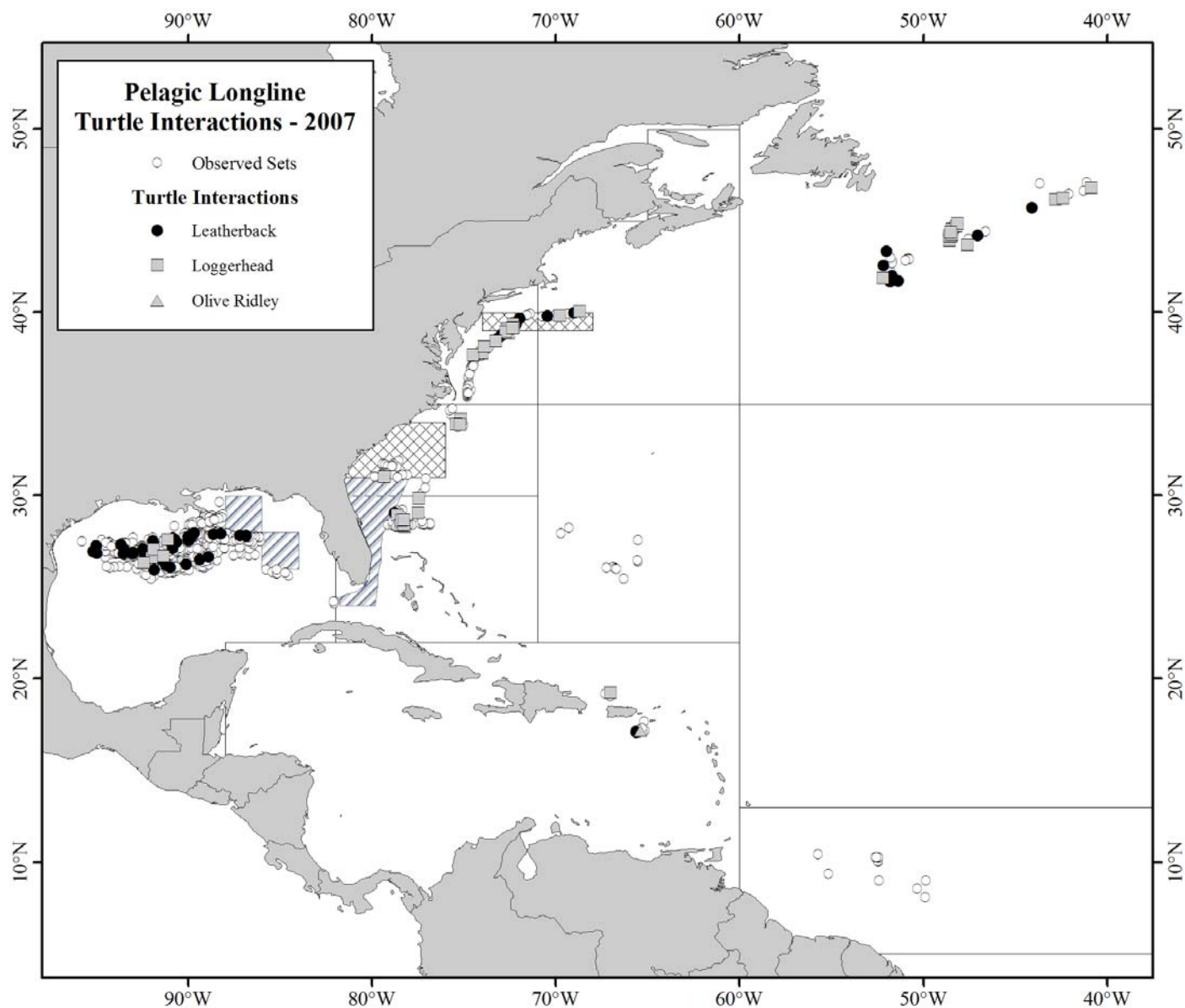
**Figure 1.** Pelagic longline fishing areas in the North Atlantic Ocean: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North, TUS = Tuna South. Year-round closed areas in the DeSoto Canyon (A) and the Florida East Coast (B) are indicated along with seasonal closures in the Charleston Bump (C) and in the Mid-Atlantic (D).



**Figure 2.** Observed and reported pelagic longline fishing effort during 2007.

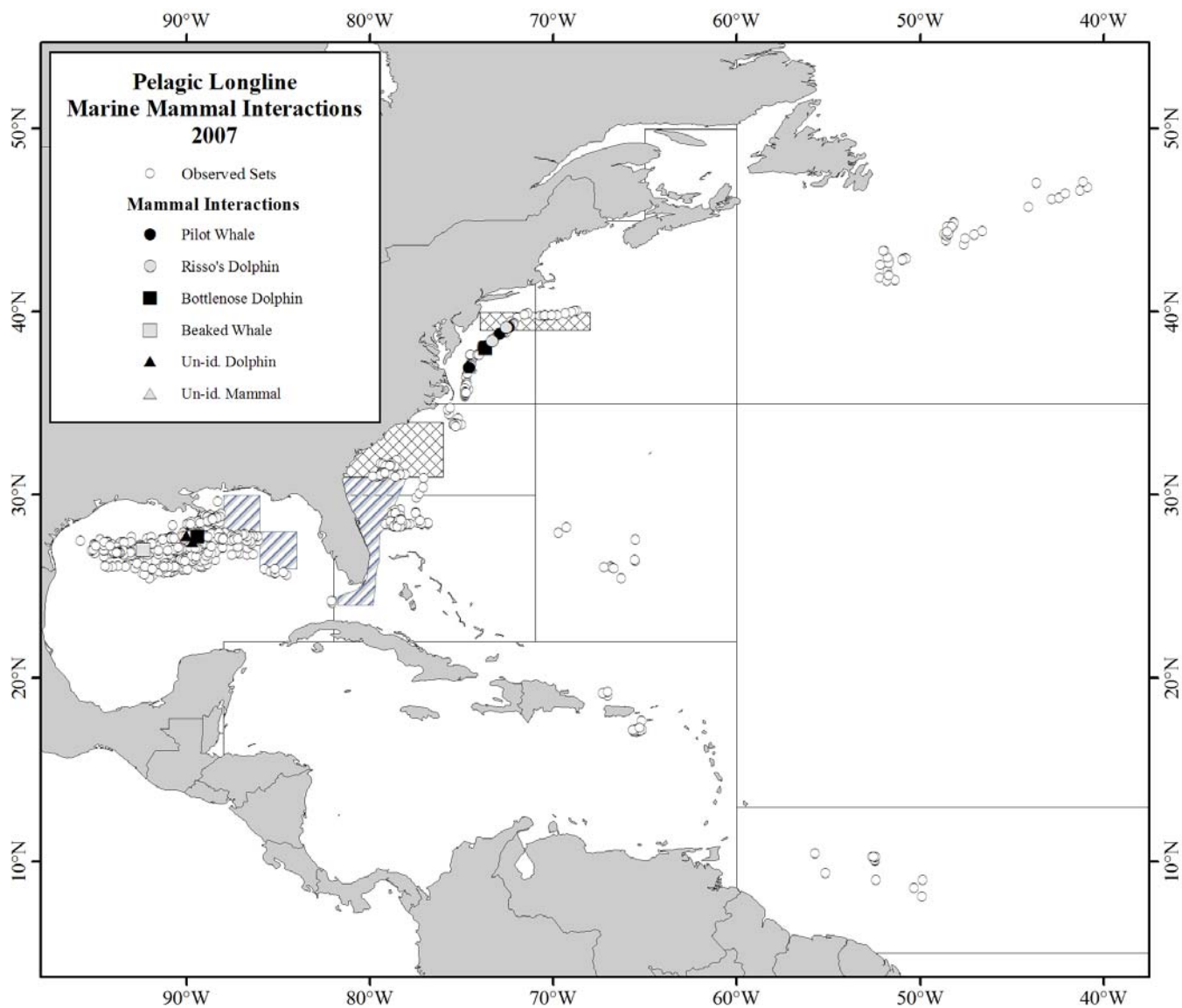


**Figure 3.** Observed pelagic longline fishing effort and sea turtle takes during 2007.



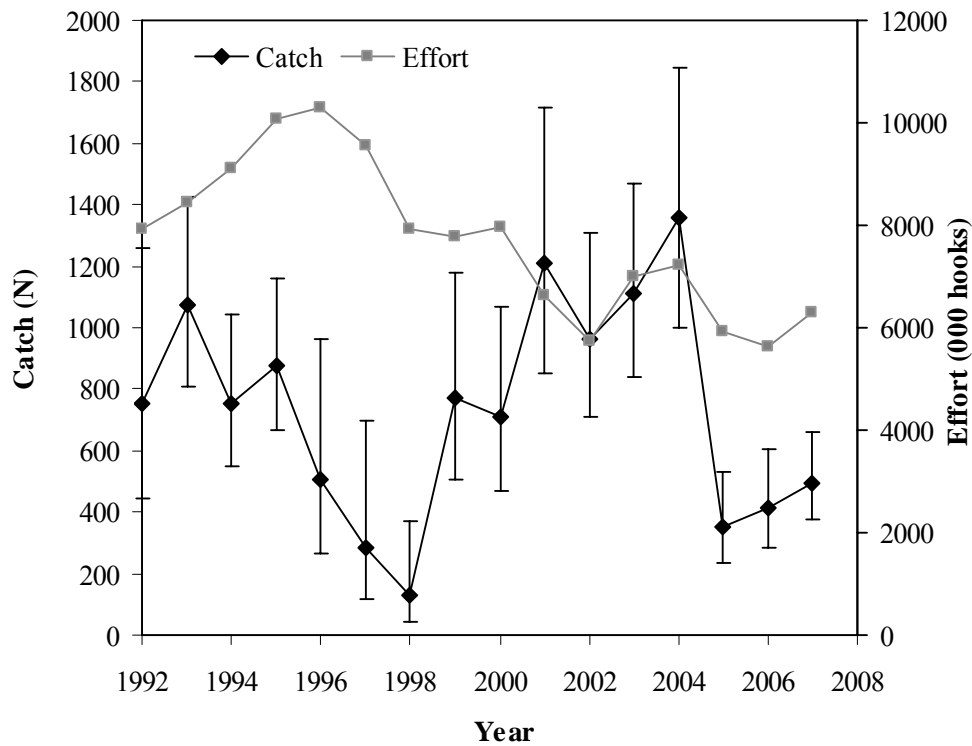


**Figure 4.** Observed pelagic longline fishing effort and marine mammal takes during 2007.

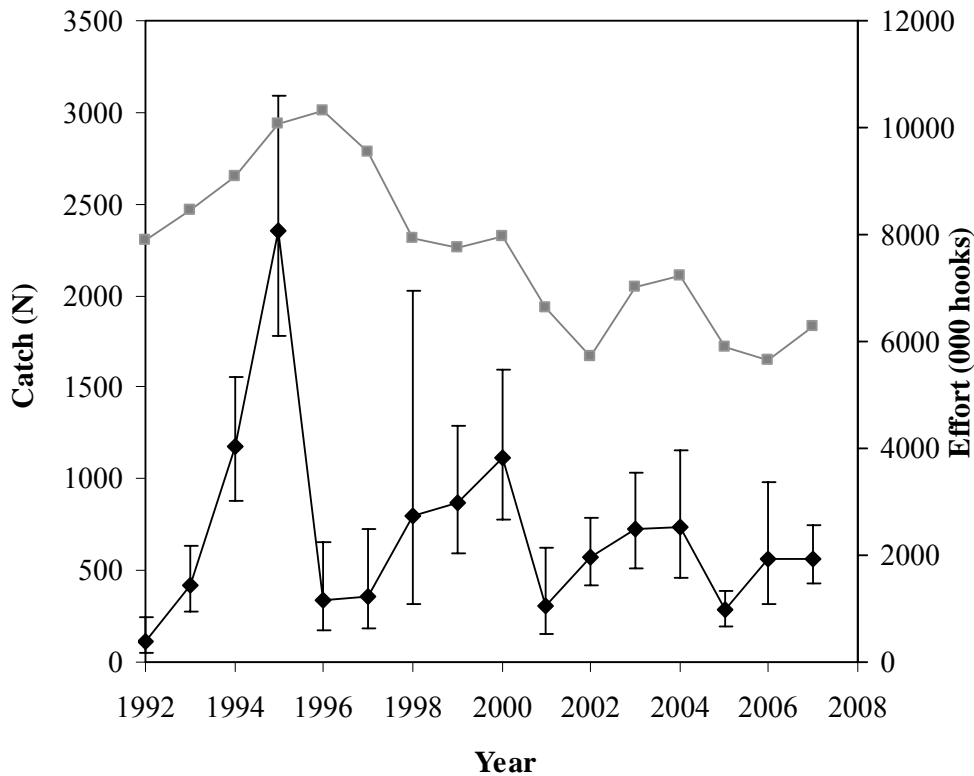


**Figure 5.** Historical trends in fishery effort and estimated marine turtle takes in the pelagic longline fishery between 1992 and 2007 for A) Leatherback Turtles, and B) Loggerhead Turtles. Errors bars represent 95% confidence intervals.

### A. Leatherback Turtles

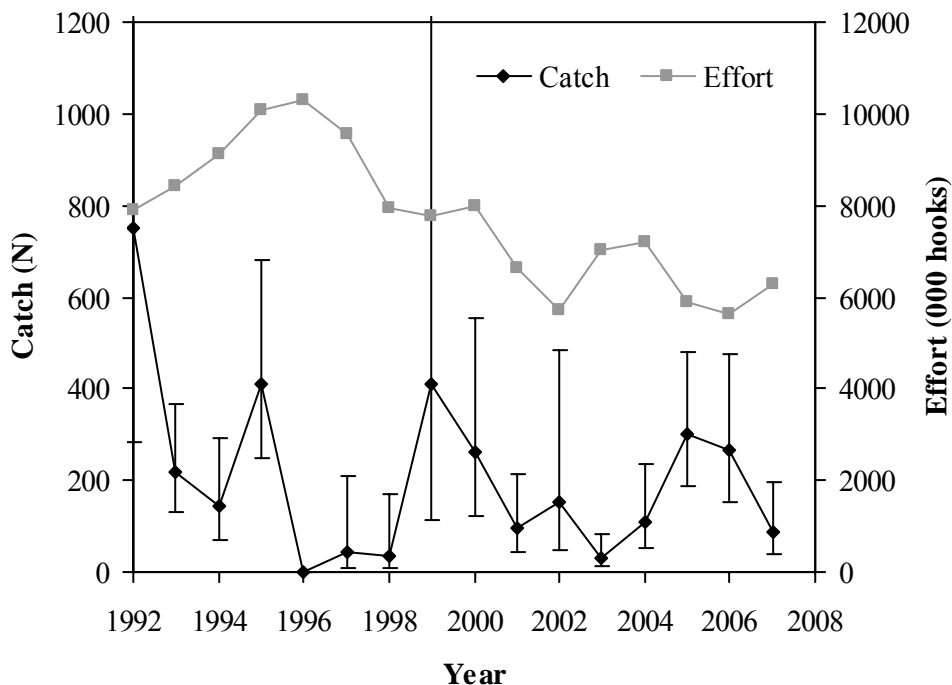


### B. Loggerhead Turtles

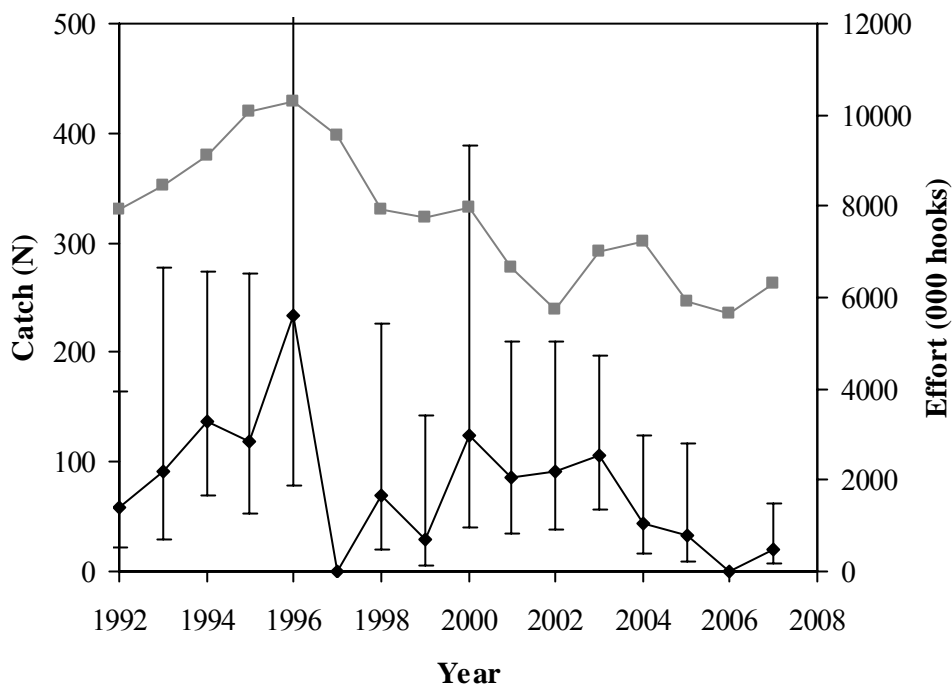


**Figure 6.** Historic trends in fishery effort and estimated marine mammal takes in the pelagic longline fishery between 1992 and 2007 for A) Pilot Whales and B) Risso's Dolphins. Errors bars represent 95% confidence intervals.

#### A. Pilot Whales



#### B. Risso's Dolphins



# Appendix A. Sea Turtle Life History Form

## CAPTURE INFORMATION

TRIP  YEAR 20 MONTH  DAY   
SET/HAUL/TOW  SPECIMEN NUMBER BY TRIP

GEAR TYPE: ☐ Longline ☐ Gill Net ☐ Trawl (note time in comments)

GEAR DEPTH: ☐ Surface ☐ Midwater ☐ Bottom ☐ Other

TIME (24 hr)  WATER TEMP (°F)

LATITUDE  deg  min N/S LONGITUDE  deg  min E/W

Did turtle slide out/escape from gear? Y / N Was turtle brought on board? Y / N

**IDENTIFICATION** (see back)

Number of Photos Taken?

SPECIES: ☐ Leatherback ☐ Loggerhead ☐ Kemp's ridley ☐ Green ☐ Hawksbill ☐ Olive ridley  
☐ Unidentified Hardshell ☐ Unknown

**CONDITION OF TURTLE AT CAPTURE**

☐ Injured ☐ Uninjured ☐ Unknown

(Please check injury status above as well as condition below)

☐ Previously dead ☐ Fresh dead ☐ Comatose Attempted resuscitation? Y / N  
☐ Alive ☐ Unknown (describe) ☐ Other (describe)

**IF GEAR IS A FORM OF HOOK AND LINE, COMPLETE THIS SECTION, AS APPLICABLE:**

HOOK TYPE ☐ "J" ☐ Circle ☐ Other (describe) SIZE /0

MANUFACTURER/STYLE NO. DEGREE OFFSET °

BAIT ☐ Squid ☐ Mackerel ☐ Sardine ☐ Unknown ☐ Other (describe) SIZE

Caught on hook timer? Y / N If yes, fill in time elapsed

Was light stick on hook? Y/N/U Circle: White, Pink, Blue, Green, Black, Red, Yellow, Purple, Aqua, Other, Unknown

If No, number of gangions to next light stick

Light Stick Color (circle)? White, Pink, Blue, Green, Black, Red, Yellow, Purple, Aqua, Other, Unknown

Number of gangions to next float

## HOOK LOCATION

(circle specific location; check box if specifics are not known; annotate drawing on reverse to indicate location as needed):

☐ Not Hooked ☐ Not Known if Hooked ☐ Hooked, but location totally Unknown

Internal: ☐ Unknown, internal

☐ Swallowed (Esophagus) Hook visible? Visible to insertion point / Partial hook / Not visible

☐ Beak/ Mouth (Circle one) Jaw Location (Check one) ☐ upper ☐ lower ☐ side (mouth only)

Check one for mouth: ☐ tongue ☐ glottis ☐ roof of mouth ☐ jaw joint ☐ other (describe)

External: ☐ Unknown, external ☐ Beak/Head/Neck ☐ Carapace/Plastron

☐ Front Flipper/Shoulder/Armpit ☐ Rear Flipper/Groin/Tail

Was hook removed from this animal? Y / N / Unknown / Not Applicable

Was animal entangled in gear? At capture? Y / N / Unknown At Release? Y / N / Unknown

How much gear (linear feet) was left on turtle when released?  ft. (estimated/measured)

Estimated carapace length (notch-to-tip straight line):  ft (needed only if turtle is not boated & measured)

# Appendix A. Sea Turtle Life History Form (cont.)

## BIOLOGICAL INFORMATION

<b><u>DIMENSIONS (cm)</u></b>	Curved (measuring tape)	Straight Line (calipers)	Straight Line (calipers)
	Standard Measurements	Standard Measurements	
Carapace Length	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> notch-to-tip	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> notch-to-tip	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> notch-to-notch
Carapace Width	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	

**TAGS** (identify address on each tag in the comments section)

Flipper Tag Number	Metal (1) or Plastic (2)	Position (Flipper) LF, RF, LR, RR	Already Present (1) or Applied By Observer (2)	Were Tags Removed?
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<b>PIT Tag</b>				
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		<input type="text"/> <input type="text"/>	<input type="text"/>	Scanned? Y / N
Living Tag (describe) _____		Other Tags (describe) _____		

(Put PIT tag label here)

**BIOPSY SAMPLES TAKEN?** Y (itemize below) / N / Unsuccessful (If yes, USFWS 3-177 form may be needed)

### RELEASE INFORMATION

LATITUDE  deg  min N / S LONGITUDE  deg  min E / W

TIME (24 hr)  WATER TEMP (°F) .

DATE, if different from capture: YEAR 20  MONTH  DAY

### FINAL DISPOSITION

☐ Discarded Marked Dead/Unresponsive Carcass ☐ Discarded Unmarked Dead/Unresponsive Carcass

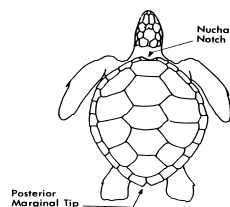
☐ Salvaged Carcass/Parts (explain) ☐ Released Alive ☐ Taken to Holding Facility ☐ Unknown (explain)

**ADDITIONAL COMMENTS** (list all biological samples collected; describe or sketch any anomalies):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



### IDENTIFICATION CRITERIA

Number of:

Left Lateral Scutes	<input type="checkbox"/>	Overlapping Scutes?	Y / N / U	Does Nuchal Scute Touch 1 <sup>st</sup> Lateral Scute? Y / N / U
Right Lateral Scutes	<input type="checkbox"/>	Inframarginal Pores?	Y / N / U	
Vertebral Scutes	<input type="checkbox"/>	1 Pair Prefrontal Scales?	Y / N / U	
L. Inframarginal Scutes	<input type="checkbox"/>	Lacks Bony Shell?	Y / N	
R. Inframarginal Scutes	<input type="checkbox"/>			

Dorsal Coloration ☐ Black ☐ Orange/Red-Brown ☐ Brown

☐ Gray-Green ☐ Other \_\_\_\_\_

## **Appendix B. Detail Information on Observed Interactions with Protected Species**

**Table B1.** Observed interactions per longline set with marine turtles during 2007. All turtles were released alive (injured or uninjured). The number of hooks set along with the number of turtles captured in each set are reported.

<b>Species</b>	<b>Quarter</b>	<b>Area</b>	<b># Hooks</b>	<b># Turtles Alive</b>	<b># Turtles Dead</b>
Leatherback	1	FEC	960	1	0
Leatherback	2	CAR	792	1	0
Leatherback	2	GOM	821	1	0
Leatherback	2	GOM	924	2	0
Leatherback	2	GOM	924	1	0
Leatherback	2	GOM	503	1	0
Leatherback	2	GOM	864	1	0
Leatherback	2	GOM	1000	1	0
Leatherback	2	GOM	768	1	0
Leatherback	2	GOM	896	1	0
Leatherback	2	GOM	892	1	0
Leatherback	2	GOM	892	1	0
Leatherback	2	GOM	888	1	0
Leatherback	2	GOM	729	1	0
Leatherback	2	GOM	906	1	0
Leatherback	2	GOM	775	1	0
Leatherback	2	GOM	729	1	0
Leatherback	2	GOM	760	2	0
Leatherback	2	GOM	936	1	0
Leatherback	2	GOM	792	1	0
Leatherback	2	GOM	720	1	0
Leatherback	2	GOM	816	1	0
Leatherback	2	GOM	792	1	0
Leatherback	2	GOM	810	1	0
Leatherback	2	GOM	832	1	0
Leatherback	2	GOM	832	1	0
Leatherback	2	GOM	896	1	0
Leatherback	2	GOM	920	1	0
Leatherback	2	GOM	920	1	0
Leatherback	2	GOM	920	1	0
Leatherback	3	GOM	400	1	0
Leatherback	3	MAB	955	1	0
Leatherback	3	MAB	985	1	0
Leatherback	3	MAB	1265	1	0
Leatherback	3	NEC	1080	1	0
Leatherback	3	NEC	1080	1	0
Leatherback	3	NEC	1080	1	0
Leatherback	3	NED	1008	1	0
Leatherback	3	NED	980	1	0
Leatherback	3	NED	1008	1	0
Leatherback	3	NED	800	1	0
Leatherback	3	NED	800	1	0
Leatherback	3	NED	920	1	0
Leatherback	4	GOM	924	1	0

**Appendix B, Table B1 cont.**

<b>Species</b>	<b>Quarter</b>	<b>Area</b>	<b># Hooks</b>	<b># Turtles Alive</b>	<b># Turtles Dead</b>
Leatherback	4	GOM	912	2	0
Leatherback	4	GOM	908	1	0
Leatherback	4	GOM	840	1	0
Leatherback	4	GOM	936	1	0
Leatherback	4	GOM	704	2	0
Leatherback	4	GOM	704	1	0
Leatherback	4	GOM	704	1	0
Leatherback	4	GOM	880	1	0
Leatherback	4	MAB	984	1	0
Leatherback	4	MAB	988	1	0
Leatherback	4	MAB	1068	1	0
Leatherback	4	MAB	1080	1	0
Leatherback	4	MAB	820	1	0
Leatherback	4	MAB	1080	1	0
Leatherback	4	MAB	1080	1	0
Leatherback	4	MAB	1080	1	0
Leatherback	4	NED	768	1	0
Leatherback	4	NED	800	1	0
Leatherback	4	NED	768	1	0
Leatherback	4	NED	768	1	0
Leatherback	4	NED	788	1	0
Loggerhead	1	CAR	844	1	0
Loggerhead	1	FEC	1200	1	0
Loggerhead	1	FEC	1200	1	0
Loggerhead	1	SAB	924	1	0
Loggerhead	1	SAB	966	1	0
Loggerhead	1	SAB	966	1	0
Loggerhead	2	FEC	624	1	0
Loggerhead	2	FEC	482	1	0
Loggerhead	2	GOM	720	1	0
Loggerhead	2	GOM	865	1	0
Loggerhead	2	GOM	768	1	0
Loggerhead	2	GOM	768	1	0
Loggerhead	2	GOM	729	2	0
Loggerhead	3	FEC	408	1	0
Loggerhead	3	FEC	438	1	0
Loggerhead	3	FEC	432	1	0
Loggerhead	3	MAB	980	1	0
Loggerhead	3	MAB	965	1	0
Loggerhead	3	MAB	766	1	0
Loggerhead	3	MAB	630	1	0
Loggerhead	3	MAB	1285	2	0
Loggerhead	3	MAB	1285	1	0
Loggerhead	3	MAB	1265	1	0
Loggerhead	3	MAB	900	1	0
Loggerhead	3	MAB	1080	1	0
Loggerhead	3	NEC	960	1	0
Loggerhead	3	NEC	1080	1	0
Loggerhead	3	NED	1004	2	0
Loggerhead	3	NED	1008	1	0
Loggerhead	3	NED	964	1	0

**Appendix B, Table B1 cont.**

<b>Species</b>	<b>Quarter</b>	<b>Area</b>	<b># Hooks</b>	<b># Turtles Alive</b>	<b># Turtles Dead</b>
Loggerhead	3	NED	1008	2	0
Loggerhead	3	NED	980	1	0
Loggerhead	3	NED	968	2	0
Loggerhead	3	NED	1008	3	0
Loggerhead	3	NED	1008	1	0
Loggerhead	3	NED	1000	1	0
Loggerhead	3	NED	896	1	0
Loggerhead	3	NED	800	12	0
Loggerhead	3	NED	800	1	0
Loggerhead	3	NED	920	1	0
Loggerhead	3	NED	960	1	0
Loggerhead	3	NED	960	1	0
Loggerhead	3	SAB	600	1	0
Loggerhead	4	FEC	496	1	0
Loggerhead	4	FEC	508	1	0
Loggerhead	4	MAB	1144	2	0
Loggerhead	4	MAB	1192	1	0
Loggerhead	4	MAB	1080	1	0
Olive Ridley	2	CAR	828	1	0



## Appendix B cont.

**Table B2.** Information is presented on gear types and hooking locations based upon observed comments and the sea turtle life history form for each A) Leatherback, B) Loggerhead, and C) Olive Ridley sea turtle observed taken during 2007. These data are summarized in Table 5. Q indicates calendar quarter, CL Est. indicates an estimated carapace length in feet, CCL indicates a measured curved carapace length in cm, and Straight N-N indicates a straight line measurement of the turtle carapace from notch to notch (see Appendix A).

### A. Leatherback Turtles

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	FEC	1	C-18/0	0	squid or mackerel	189 or 378	Alive, injured	Released alive	armpit	Yes	No	No	0.00	5.00		
2	CAR	2	C-18/0	10	squid	113	Alive, uninjured	Released alive	not hooked	N/A	Yes	No	0.0	4.0		
3	GOM	2	C-18/0	0	sardine	90	Alive, uninjured	Released alive	not hooked	N/A	Yes	No	0.0	6.0		
4	GOM	2	C-16/0	0	squid	180	Alive, injured	Released alive	not hooked	N/A	Yes	Yes	20.0	5.0		
5	GOM	2	C-16/0	0	squid	100	Alive, injured	Released alive	beak (external)/head/neck	No	No	No	1.0	5.0		
6	GOM	2	C-16/0	0	squid	258	Alive, injured	Released alive	mouth, side, jaw joint	No	No	No	5.0	7.0		
7	GOM	2	C-16/0	0	squid	100	Alive, injured	Released alive	neck	No	No	No	3.0	4.0		
8	GOM	2	C-16/0	0	squid	182	Alive, injured	Released alive	shoulder	No	No	No	0.0	6.0		
9	GOM	2	C-16/0	0	squid	300	Alive, injured	Released alive	shoulder	No	No	No	0.3	5.0		
10	GOM	2	C-16/0	0	squid	186	Alive, injured	Released alive	shoulder	No	No	No	0.5	7.0		
11	GOM	2	C-16/0	0	sardine	70	Alive, injured	Released alive	shoulder	No	No	No	0.8	5.0		
12	GOM	2	C-16/0	0	squid	136	Alive, injured	Released alive	shoulder	No	No	No	2.0	5.0		

**Appendix B, Table B2, Leatherback Turtles cont.**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
13	GOM	2	C-16/0	0	sardine	85	Alive, injured	Released alive	shoulder	No	No	No	3.0	4.0		
14	GOM	2	C-16/0	0	squid	150	Alive, injured	Released alive	shoulder	No	No	No	4.5	6.5		
15	GOM	2	C-18/0	0	squid	183	Alive, injured	Released alive	armpit	No	No	No	0.1	4.5		
16	GOM	2	C-16/0	0	squid	300	Alive, injured	Released alive	armpit	No	No	No	1.0	5.0		
17	GOM	2	C-16/0	0	squid	300	Alive, injured	Released alive	armpit	No	No	No	1.0	5.0		
18	GOM	2	C-16/0	0	squid	258	Alive, injured	Released alive	armpit	No	No	No	7.0	5.0		
19	GOM	2	C-16/0	0	squid	170	Alive, injured	Released alive	armpit	No	Yes	No	10.0	6.0		
20	GOM	2	C-16/0	0	squid	182	Alive, injured	Released alive	front flipper	No	No	No	0.5	5.0		
21	GOM	2	C-16/0	0	squid	179	Alive, injured	Released alive	front flipper	No	No	No	0.5	7.0		
22	GOM	2	C-16/0	0	squid	258	Alive, injured	Released alive	front flipper/ shoulder/ armpit	No	No	No	4.0	5.0		
23	GOM	2	C-16/0	0	squid	180	Alive, injured	Released alive	front flipper/ shoulder/ armpit	No	No	No	10.0	4.0		
24	GOM	2	C-16/0	0	squid	180	Alive, injured	Released alive	front flipper/ shoulder/ armpit	No	No	Unknown	10.0	4.0		
25	GOM	2	C-16/0	0	squid	180	Alive, injured	Released alive	unknown external	No	Yes	Yes	9.0	5.0		
26	GOM	2	C-16/0	0	squid	100	Alive, injured	Released alive	unknown	No	Yes	Yes	3.0	5.0		
27	GOM	2	C-16/0	0	squid	284	Alive, injured	Released alive	unknown	No	No	No	10.0	5.0		

**Appendix B, Table B2, Leatherback Turtles cont.**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
28	GOM	2	C-16/0	0	sardine	54	Alive, injured	Released alive	unknown	No	No	No	12.0	3.0		
29	GOM	2	C-16/0	0	squid	150	Alive, injured	Released alive	unknown	No	Yes	Unknown	6.0	7.0		
30	GOM	2	C-16/0	0	squid	180	Alive, injured	Released alive	unknown	No	Unknown	Unknown	10.0	3.5		
31	GOM	2	C-16/0	0	squid	125	Alive, unknown	Released alive	not known if hooked	Yes	Yes	No	0.0	5.0		
32	GOM	2	C-16/0	0	squid	179	Unknown	Unknown	not known if hooked	No	Unknown	Unknown	60.0	6.0		
33	GOM	3	C-16/0	0	squid	225	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0	5.0		
34	MAB	3	C-18/0	10	squid or mackerel	163.5 or 544.8	Alive, unknown	Released alive	not known if hooked	Yes	Yes	No	0.0	4.0		
35	MAB	3	C-18/0	10	squid	158	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	4.0		
36	MAB	3	C-18/0	10	squid	350	Alive, injured	Released alive	shoulder	No	No	No	0.0	5.0		
37	NEC	3	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	unknown external	Yes	No	No	0.0	5.0		
38	NEC	3	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	shoulder	No	No	No	0.0	5.5		
39	NEC	3	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	5.5		
40	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	5.1		
41	NED	3	C-18/0	10	squid	244	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	5.0		
42	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	armpit	Yes	Yes	No	0.0	6.0		
43	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	armpit	Yes	No	No	0.0	6.0		

**Appendix B, Table B2, Leatherback Turtles cont.**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
44	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	armpit	Yes	No	No	0.0	4.0		
45	NED	3	C-18/0	10	mackerel	370	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.0	5.0		
46	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	armpit	Yes	No	No	0.0	4.5		
47	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	armpit	Yes	No	No	0.0	5.0		
48	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	armpit	No	Yes	No	0.0	5.5		
49	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.0	5.0		
50	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	armpit	No	No	No	0.2	5.0		
51	NED	4	C-18/0	10	squid	396	Alive, injured	Released alive	armpit	No	No	No	1.5	5.5		
52	NED	4	C-18/0	10	squid or mackerel	199 or 408	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	5.5		
53	NED	4	C-18/0	10	squid or mackerel	213 or 408	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	4.5		
54	NED	4	C-18/0	10	squid or mackerel	199 or 400	Alive, injured	Released alive	shoulder	No	Yes	No	0.1	4.5		
55	NED	4	C-18/0	10	squid or mackerel	189 or 406	Alive, injured	Released alive	armpit	No	No	No	0.1	5.0		
56	MAB	4	C-18/0	10	squid or mackerel	203 or 369	Alive, uninjured	Released alive	not hooked	n/a	No	No	0.0	4.0		
57	MAB	4	C-18/0	10	mackerel	312.5	Alive, injured	Released alive	shoulder	No	No	No	12.0	5.0		
58	MAB	4	C-18/0	10	mackerel	298	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	5.0		
59	MAB	4	C-18/0	10	mackerel	303	Alive, injured	Released alive	shoulder	No	No	No	0.5	6.0		

**Appendix B, Table B2, Leatherback Turtles cont.**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
60	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0	5.0		
61	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	4.0		
62	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	swallowed, hook not visible	No	No	No	1.0	4.0		
63	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	4.0		
64	GOM	4	C-16/0	0	squid	300	Alive, injured	Released alive	shoulder	No	No	No	1.0	5.0		
65	GOM	4	C-16/0	0	squid	350	Alive, injured	Released alive	front flipper	No	No	No	0.5	4.0		
66	MAB	4	C-18/0	10	squid	225	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	4.0		
67	MAB	4	C-18/0	10	squid	225	Alive, injured	Released alive	unknown external	Yes	No	No	0.0	6.0		
68	MAB	4	C-18/0	10	squid	225	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	5.5		
69	MAB	4	C-18/0	10	squid	225	Alive, unknown	Released alive	not known if hooked	Yes	Yes	Unknown	5.0	6.0		

**Appendix B, Table B2 cont.**

**B. Loggerhead Turtles**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	CAR	1	C-18/0	10	squid	269	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		79	71.8
2	FEC	1	C-18/0	10	mackerel	450	Alive, unknown	Released alive	not known if hooked	Yes	No	No	0.00	2.30		
3	FEC	1	C-18/0	10	squid	248	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.00		74	66.7
4	SAB	1	C-18/0	10	squid	206	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		60.1	52.8
5	SAB	1	C-18/0	10	squid or mackerel	196 or 227	Alive, injured	Released alive	tongue	Yes	No	No	0.00		70.4	64.1
6	SAB	1	C-16/0	10	squid or mackerel	197 or 227	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.00		73.1	65.3
7	FEC	2	C-18/0	10	squid	316	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		68.5	65.3
8	FEC	2	C-18/0	10	squid	316	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		64.4	57.9
9	GOM	2	C-16/0	0	squid	182	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		70.5	64.7
10	GOM	2	C-16/0	0	squid	136	Alive, injured	Released alive	mouth, side	Yes	No	No	0.0	3.0		
11	GOM	2	C-16/0	0	squid	150	Alive, injured	Released alive	tongue	Yes	No	No	0.0	2.5		
12	GOM	2	C-16/0	0	squid	136	Alive, injured	Released alive	tongue	Yes	No	No	0.0		95.2	
13	GOM	2	C-16/0	0	squid	182	Alive, injured	Released alive	swallowed hook not visible	No	No	No	0.8		75.1	70.5
14	GOM	2	C-18/0	0	squid	209	Alive, injured	Released alive	unknown	No	Unknown	Unknown	120.0	3.0		
15	FEC	3	C-16/0	0	squid	205	Alive, injured	Released alive	swallowed partial visible	No	No	No	0.1			
16	FEC	3	C-18/0	10	squid	193	Alive, injured	Released alive	beak internal, lower jaw	No	No	No	0.5	3.5		

**Appendix B, Table B2, Loggerhead Turtles cont**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
17	FEC	3	C-16/0	0	squid	300	Alive, injured	Released alive	beak internal, lower jaw	No	No	No	0.1	4.0		
18	MAB	3	C-18/0	10	squid or mackerel	197.6 or 181.6	Alive, injured	Released alive	swallowed , partial hook visible	No	No	No	0.0			
19	MAB	3	C-18/0	10	squid or mackerel	197.6 or 181.6	Alive, injured	Released alive	swallowed , visible to insertion pt.	Yes	No	No	0.0			
20	MAB	3	C-18/0	10	squid or mackerel	181.6 or 544.8	Alive, injured	Released alive	Mouth, lower, glottis	Yes	No	No	0.0			
21	MAB	3	C-18/0	10	squid or mackerel	197.6 or 181.6	Alive, injured	Released alive	mouth, lower, tongue	Yes	No	No	0.0			
22	MAB	3	C-18/0	10	squid	350	Alive, injured	Released alive	mouth, lower, tongue	Yes	No	No	0.0			
23	MAB	3	C-18/0	10	squid or mackerel	161.7 or 544.8	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0			
24	MAB	3	C-16/0	0	squid	225	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0			
25	MAB	3	C-16/0	0	squid	300	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0			
26	MAB	3	C-16/0	0	squid	300	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0			
27	MAB	3	C-16/0	0	squid	225	Alive, injured	Released alive	front flipper	No	No	No	3.0			
28	NEC	3	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
29	NEC	3	C-18/0	10	squid	199	Alive, injured	Released alive	rear flipper	Yes	No	No	0.0			
30	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	swallowed , partial hook visible	No	No	No	0.2			

**Appendix B, Table B2, Loggerhead Turtles cont**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
31	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	swallowed , partial hook visible	No	No	No	0.0			
32	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	swallowed , visible to insertion point	Yes	No	No	0.0			
33	NED	3	C-18/0	10	squid	244	Alive, injured	Released alive	swallowed , visible to insertion point	Yes	No	No	0.0			
34	NED	3	C-18/0	10	mackerel	370	Alive, injured	Released alive	swallowed , visible to insertion point	Yes	No	No	0.0			
35	NED	3	C-18/0	10	squid	244	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.5			
36	NED	3	C-18/0	10	squid	244	Alive, injured	Released Alive	mouth, upper, roof of mouth	Yes	No	No	0.0			
37	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	mouth, upper, roof of mouth	Yes	No	No	0.0			
38	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0			
39	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0			
40	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0			
41	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released Alive	mouth, lower jaw, other	Yes	No	No	0.0			
42	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0			
43	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released Alive	mouth, lower jaw, other	Yes	No	No	0.0			



**Appendix B, Table B2, Loggerhead Turtles cont**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
44	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0			
45	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.0			
46	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.0			
47	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, side, unknown	Yes	No	No	0.0			
48	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	beak internal, upper jaw	Yes	No	No	0.0			
49	NED	3	C-18/0	10	squid or mackerel	246.8 or 373.6	Alive, injured	Released alive	beak internal, upper jaw	Yes	No	No	0.0			
50	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
51	NED	3	C-18/0	10	mackerel	370	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
52	NED	3	C-18/0	10	mackerel	370	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
53	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
54	NED	3	C-18/0	10	squid	244	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
55	NED	3	C-18/0	10	squid	244	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0			
56	NED	3	C-18/0	10	mackerel	216	Alive, injured	Released alive	front flipper	Yes	No	No	0.0			
57	NED	3	C-18/0	10	squid or mackerel	217 or 246.3	Alive, injured	Released alive	front flipper	Yes	No	No	0.0			
58	NED	3	C-18/0	10	mackerel	216	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0			
59	NED	3	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0			

**Appendix B, Table B2, Loggerhead Turtles cont**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
60	NED	3	C-18/0	10	mackerel	216	Alive, unknown	Released alive	not known if hooked	Yes	No	No	0.0			
61	SAB	3	C-18/0	10	mackerel	240	Alive, injured	Released alive	Beak internal, lower jaw	Yes	No	No	0.0			
62	FEC	4	C-18/0	10	squid	300	Alive, injured	Released alive	mouth, upper, roof of mouth	Yes	No	No	0.0		63.0	
63	FEC	4	C-18/0	10	squid	300	Alive, injured	Released alive	beak (internal)/ mouth, lower jaw	No	No	No	0.0	3.0		
64	MAB	4	C-18/0	10	squid	300	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		78.8	71.8
65	MAB	4	C-18/0	10	squid or mackerel	238 or 349	Alive, injured	Released alive	swallowed , partial hook visible	No	No	No	0.0		74.0	66.2
66	MAB	4	C-18/0	10	squid or mackerel	209.5 or 372	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0		86.1	75.7
67	MAB	4	C-18/0	10	squid	225	Alive, injured	Released alive	swallowed , partial hook visible	No	No	No	0.0		76.2	68.0

**Appendix B, Table B2 cont.**

**C. Olive Ridley Turtles**

#	Area	Q	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	CAR	2	C-18/0	10	squid	113	Alive, injured	Released alive	tongue	Yes	Yes	No	0.0		60.0	55.5

## Appendix B cont.

**Table B3.** The observed 2007 interactions per longline set with marine mammals. The number of hooks set along with the number of mammals by release status (alive, seriously injured, or dead) in each set is reported.

Species	Quarter	Area	# Hooks(x 1000)	# Alive	# Serious Injury	# Dead
Unid. Beaked Whale	2	GOM	304.5	1	0	0
Bottlenose Dolphin	2	GOM	304.5	1	0	0
Unidentified Dolphin	2	GOM	304.5	1	0	1
Pilot Whale	3	MAB	41.4	1	4	0
Unidentified Marine Mammal	3	MAB	41.4	0	2	0
Risso's Dolphin	3	MAB	41.4	0	1	0
Bottlenose Dolphin	4	MAB	52.4	1	0	0
Pilot Whale	4	MAB	52.4	2	1	0
Risso's Dolphin	4	MAB	52.4	0	1	0

## Appendix B cont.

**Table B4:** 2007 observer comments and serious injury codes for marine mammals are presented. Injury codes are as follows: 5 = inability to swim or dive; 8 = cetacean is hooked internally (e.g., in the mouth); 10 = line/net entangling the animal is likely to further entangle; 13 = laceration; 14 = listlessness or inability to defend itself. Lengths (cm) are estimated visually by the observer.

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
1	Unid. Beaked Whale	600	Alive, No SI	-	Animal was brought boat-side, hauled by mainline, then a gaff was used to pull some of the loops away from the animal. Then one of the deck hands leaned down and cut them. There was very little cutting of the animal's tail by the line, and no damage to the animal while untangling. Once free, it swam slowly but under control, took a few breaths, then dove.
2	Bottlenose Dolphin	---	Alive, No SI	13	Animal pulled as close to the vessel as possible; line cut. Line around tail before caudal peduncle. Made red cuts but were not bleeding. Animal swam away.
3	Unid. Dolphin	120	Dead	5	Animal very young. It appeared that 1-2 foot of the leader to the hook was wrapped around the tail and the crew quickly cut the line. Hook and partial leader were left on the animal. Sank motionless out of sight after being cut off, and considered dead. When setting gear there were a group of dolphins all around the boat and the gear was being set. They had a black stripe along top of body (Spinners?). No adjustments were made to avoid the animals. The biopsy pole was closer than camera, but crew cut line before I could take sample. Last hook set that caught the dolphin.
4	Unid. Dolphin	120	Alive, No SI	-	Animal all gray in color. Juvenile animal with darker gray under dorsal fin. No visible spots. Slender body. If had to guess would say juvenile pantropical spotted. MOD was entangled, not hooked. The hook formed a lasso with gangion around tail. All gear removed. Once the gangion was cut, the hook and gangion fell off animal. Then MOD swam away quickly. MOD was relatively calm coming to boat. It was pulled up tail first. After line was cut the hook fell off and animal was free. It immediately swam away from the boat very quickly.
5	Pilot Whale	300	SI	10	Mono leader cut quickly with mono clippers; 40-50 feet of line left trailing. Unknown if hooked, but a single gangion seemed to be connected with the animal's head or mouth; however observer was never able to see entire head or mouth as it never came above the surface. Alive, swam away normally.
6	Pilot Whale	300	SI	10	Mono leader cut quickly with mono clippers; 40-50 feet of line left trailing. Unknown if hooked, but a single gangion seemed to be connected with the animal's head or mouth; however observer was never able to see entire head or mouth as it never came above the surface. Alive, normal swimming upon release.

**Appendix B, Table B4 (cont.)**

<b>Animal #</b>	<b>Species</b>	<b>Length (cm)</b>	<b>Release Condition</b>	<b>Injury Code(s)</b>	<b>Observer Comments</b>
7	Pilot Whale	300	SI	10	Mono leader cut quickly with mono clippers; 40-50 feet of line left trailing. Unknown if hooked, but a single gangion seemed to be connected with the animal's head or mouth; however observer was never able to see entire head or mouth as it never came above the surface. Alive, swam away normally.
8	Pilot Whale	300	SI	5, 10, 14	Mono leader cut quickly; 40-50 feet of line left trailing. Unknown if hooked, but a single gangion seemed to be connected with the animal's head or mouth; however observer was never able to see entire head or mouth as it never came above the surface. Most likely entangled by mess of mono and dobs. Alive, swam away abnormally. Pelvic fin up in air. Animal breathing but not moving; animal would twist body to breath - observer heard breath. Animal upside down with pelvic fin out of water. Could see animal in same position as boat moved forward to the point that it was no longer visible.
9	Pilot Whale	---	Alive, No SI	-	Observer never saw animal, as he was working up a turtle. Was told by captain it was a pilot whale, but it was recorded as unknown marine mammal. Unknown if entangled or if hook or gear removed, but captain said it was released.
10	Unid. Marine Mammal	210	SI	10	Mono leader cut quickly with mono clippers; 40 feet of line left trailing. Unknown if hooked, but a single gangion seemed to be connected with the animal's head or mouth; however observer was never able to see entire head or mouth as it never came above the surface. Alive, swam away normally. Animal was slow, but swimming. There was a small group of approx. 6 animals very close to the hooked animal. Within sight of the boat, there were approx. 100 animals.
11	Unid. Marine Mammal	300	SI	10	Mono leader cut quickly; 40-50 feet of line left trailing. Unknown if hooked, but a single gangion seemed to be connected with the animal's head or mouth; however observer was never able to see entire head or mouth as it never came above the surface. Alive, swam away normally. Didn't see animal well, but resurfaced for breath after mono was cut.
12	Risso's Dolphin	210	SI	8	Cut line with long handled line cutter. Animal was hooked on side of mouth, hook not removed, line cut with 0.3 ft line left training. Alive, swam away normally upon release. It was pulling in a small circle and was very lively. Upon release it was gone diving out of sight quickly.

**Appendix B, Table B4 (cont.)**

<b>Animal #</b>	<b>Species</b>	<b>Length (cm)</b>	<b>Release Condition</b>	<b>Injury Code(s)</b>	<b>Observer Comments</b>
13	Bottlenose Dolphin	150	Alive, No SI	-	Animal was pulled in using the mainline. Then the animal was pulled partly out of the water by the line so the tail wraps were accessible. Then the captain cut the wraps away. Animal swam away without any visible injury, no cuts from line or blood observed. Animal entangled, not hooked released with no gear. (Animal) appeared energetic during and after release - took a breath then took off - alive, swam normally away.
14	Pilot Whale	240	SI	8	Animal was hooked in lower side of mouth. Attempted to unhook using long-handled dehooker. Could not get animal close enough to dehook; cut line as close to hook as possible using hand held line cutters – animal released with 3 feet of line left. Took one deep breath then dove; swam away normally.
15	Pilot Whale	180	Alive, No SI	-	Animal was hooked but could not see where the line led to the animal. The hook came off the pilot whale while the crew was hauling the line to the boat. Animal dove immediately and swam away normally.
16	Pilot Whale	240	Alive, No SI	-	Animal was not hooked, but was entangled around the tail. They pulled it to boat and used long handled line cutter to cut away all wraps around tail. When they cut the gear, the line unwrapped from tail, all gear removed. (Animal) was pulling hard and very lively all the way to boat and struggled until line was cut. When they cut the line, it (whale) quickly dove out of sight very quickly - swam away normally, alive.
17	Risso's Dolphin	270	Alive, No SI	-	Wrapped around tail stock - used LL spool to get animal close enough to free end of mainline – cleated free end to boat and pulled even closer with hydraulics and manpower. Used patience and persistence to use line cutter to cut 1 or 2 wraps. Then animal was free. Other 2-3 wraps came free – all gear removed. Observer did not see any wound caused by the entanglement, even though wraps were tight. Animal was tired while boat-side, but still thrashing around panicked while we were trying to free it. Dove upon release and resurfaced about 200 feet from boat for 2-3 breaths then dove again – alive, swam away normally.